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13th ANNUAL SYSTEMS ENGINEERING CONFERENCE MONDAY TUTORIAL SESSION

"Achieving Acquisition Excellence Via Effective Systems Engineering"

San Diego, CA

25 - 28 October 2010

Agenda

Monday, October 25, 2010

TRACK 1- SESSION A

- 10480 – 1A1 – Tutorial: *Universial Architecture Description Framework*, Mr. Jeffrey Grady, JOG System Engineering, INC-

TRACK 4- SESSION A

- 10805 – 1A4 – Tutorial: *Mentoring Fundamentals to Support Systems Engineering Workforce Development*, Mr. Nicholas Torelli, ODDR&E/SE

TRACK 6- SESSION A

- 10748 – 1A6 – Tutorial: *Risk Management and Beyond*, Mr. Al Florence, The MITRE Coporation

TRACK 8 – SESSION A

- 10803 – 1A8 – Tutorial: *NCOIC Systems, Capabilities, Operations, Programs, and Enterprises (SCOPE) Model*, Mr. Hans Polzer, Lockheed Martin

TRACK 8 – SESSION D

- 10770 – 1D8 – Tutorial: *NCOIC's Network Centric Analysis Tool (NCAT TM)*, Dr. Todd Schneider, Raytheon Company

The Seven Fundamentals of Mentoring

Nicholas M. Torelli

Systems Engineering Directorate
Office of the Director, Defense Research and Engineering

13th Annual NDIA Systems Engineering Conference
October 25, 2010

Mentoring Workshop Overview

Part I: Background

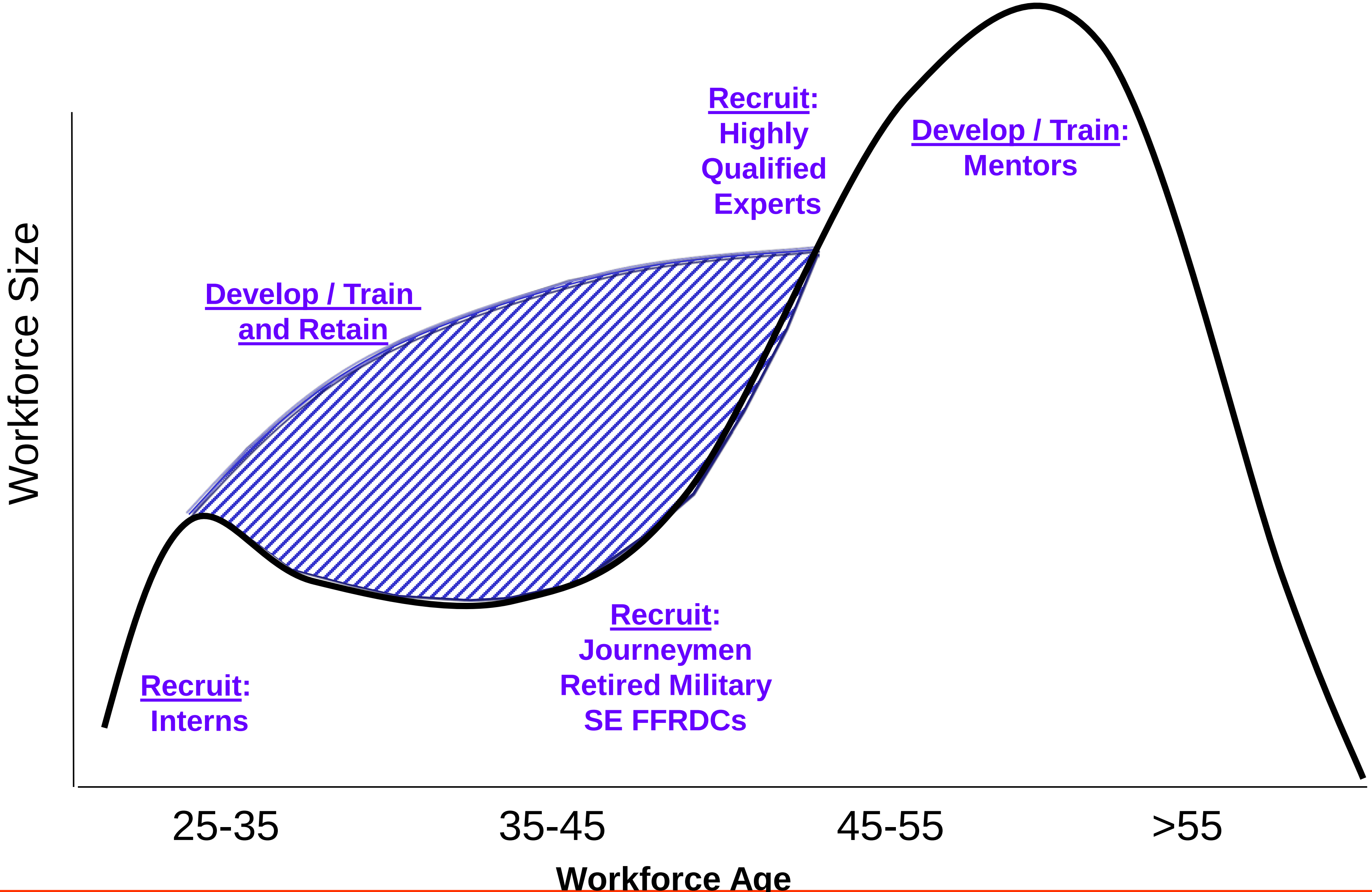
- Definition and Background
- Why We Need It
- Successful Mentoring
- Characteristics of a Good Mentor
- Benefits of Mentoring
- Protégés
- Mentoring Models
- Mentoring Relationships
- Tips for Mentoring

Break

Part II: Seven Fundamentals of Mentoring

- Mentoring Takes Place Outside of a Manager-Employee Relationship
- Mentoring is Career Focused
- Mentoring Relationships are Personal and Confidential
- Mentoring Relationships Cross Job Boundaries
- Mentoring Identifies Unique Skills and Abilities
- Mentoring Provides Insight Into the Workings of the Organization
- Mentoring Communicates Organizational and Professional Values
- Poor Mentoring Practices
- Summary

DoD Systems Engineering Workforce



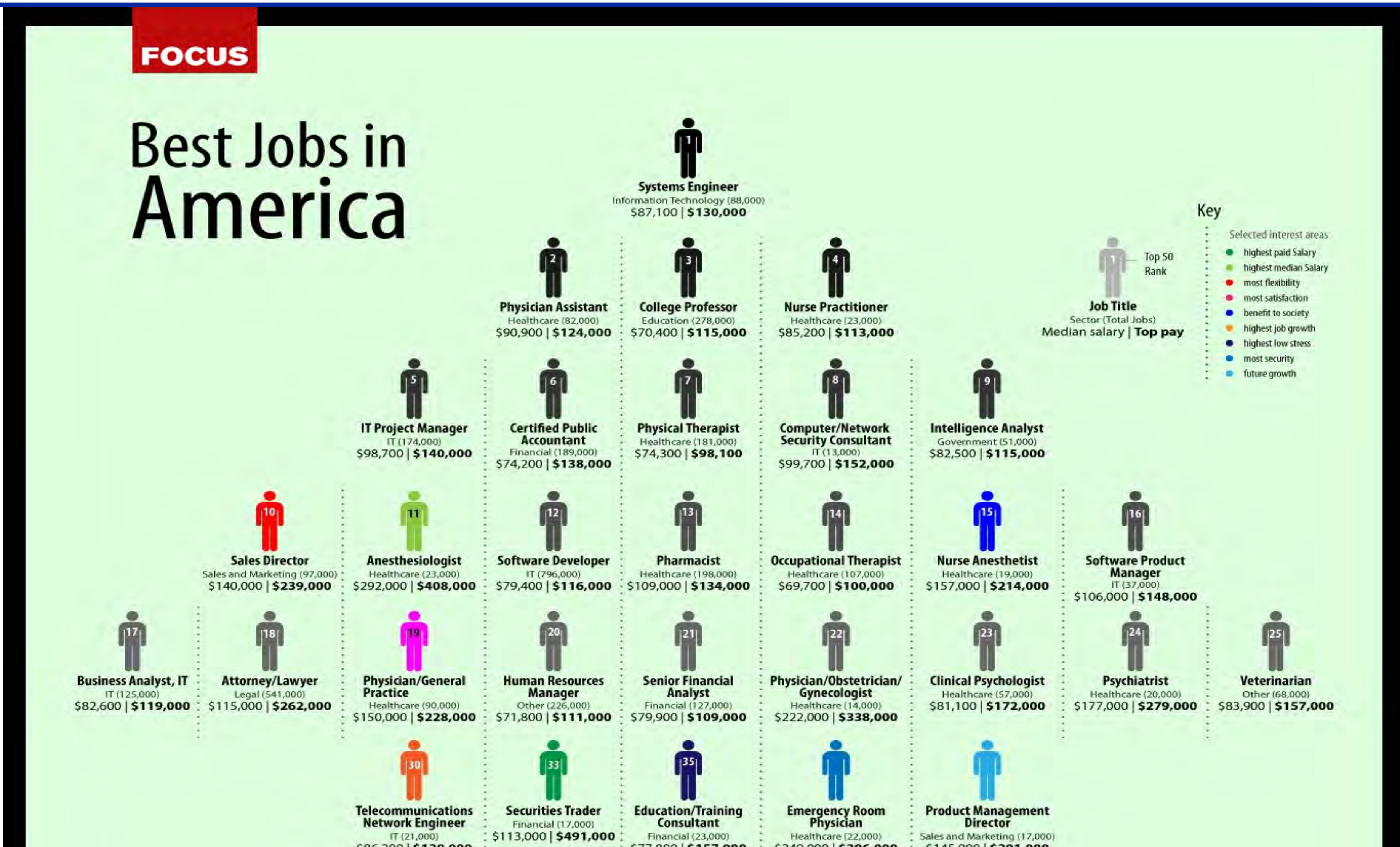
Background: DoD SE Acquisition Workforce

- **Legislation And Policy Direction**
- **Current DoD Efforts**
- **Systems Engineering – The Best Job in America?**

Workforce Development Legislation and Policy

- National Defense Authorization Act For FY 2006 (NDAA FY06): Human Capital Strategic Plan
- NDAA FY08: Section 852, DoD Acquisition Workforce Development Fund
- NDAA FY09: Weapon Systems Acquisition Reform Act
- 2010 SECDEF and USD(AT&L) Efficiency Initiatives

Systems Engineer - The Best Job in America?



Source: http://www.focus.com/fyi/human-resources/best-jobs/ c 2010 Focus - Used with permission.

Workforce Development

Technical workforce development initiatives across government, industry and academia:

- Competency Assessments for technical management career fields ("first look" in Q4 2010)
- Competency-based certification standards to enable "raising the bar" for workforce performance
- Flexible certification framework to encourage professional growth and provide the opportunity for subsequent progression to Program Management
- Expanded collaboration with civilian universities and industry associations

DDR&E/SE Serves as Functional Leader
for over 44,000 Uniformed and Civilian Acquisition Personnel
(SPRDE-SE/PSE and PQM)

Mentoring and Why We Need It

- Definition: Professional Mentoring Is Mentoring Between An Experienced Person, The Mentor, And A Less Experienced One, The Protégé, To Facilitate The Development Of The Protégé Professionally
- The Intent Of The Mentoring Process Is To Facilitate The Pace And Quality Of The New Colleague's Development Into A Competent Practicing Professional

Successful Mentoring

- **The Most Successful Mentorships Are Those That Are Built On A Shared Understanding Of Both Parties' Expectations From The Relationship, Positive Feelings About One Another, And A Lot Of Optimism About How The Relationship Will Benefit Them Both.**
- **Mentoring Is:***
  - Opportunity To Learn From Someone Who Has "Lived It"
  - Sharing Experiences And Expertise
  - Support, Encouragement, Guidance, Advice
  - Reciprocal
- **Mentoring Is Not:***
  - A Therapy Or Venting Session
  - A Be-All-End-All Source For Development
  - Manager Replacement

*Executive Mentoring Program: Executive Briefing Presentation. Dell, Inc.

Characteristics of a Good Mentor

- **Willing:** Best Practice Indicates That Mentors Should Be Willing To Fill The Mentor Role And Not Be Pressured Into Mentoring.
- **Experienced:** In General, A Mentor Should Have A Proven Track Record Of Positive Effect In The Work Environment.
- **Non-Judgmental:** A Mentor-Protégé Relationship Focuses On Developing The Protégé Professionally And Personally. The Protégé Should Feel Free To Discuss Issues Openly And Honestly, Without Worrying About Negative Consequences On The Job.

Would YOU Be a Good Mentor?

Characteristics of a Good Mentor (cont'd)

- **Good Communicator:**
  - Is Able To Articulate Effective Instructional Strategies
  - Listens Attentively
  - Asks Questions That Prompt Reflection And Understanding
  - Offers Critiques In Positive And Productive Ways
  - Uses E-mail/Social Networking Effectively
  - Efficient With The Use Of Time
  - Conveys Enthusiasm, Passion For Profession
  - Is Discreet And Maintains Confidentiality
- **Professional Competence And Experience**
- **Others ?**

Characteristics of a Good Protégé

- Able To Take Constructive Criticism
- Active Listener
- Good Communicator
- Willing To Stretch To Learn And Try New Things
- Willing To Take Risks (Shoot Higher)
- Be Able To Identify Long And Short Term Career Goals
- Willing To Accept That Those Goals May Change
- Others ?

Benefits of Mentoring for the Mentor

- Recruitment And Retention
- Improving Skills And Knowledge
- Learning Goes Both Ways
- Networking
- Helping Someone Succeed
- Personal Satisfaction

Benefits of Mentoring for the Protégé

- Exposure To Best Practices And Lessons Learned
- Networking
- Receiving Critical Feedback In Key Areas:
  - Communications
  - Work Relationships
  - Technical Abilities
  - Change Management And Leadership Skills
- Acquiring Specific Skills And Knowledge Relevant To Personal Goals
- Better Understanding Of Professional Growth Within The Organization
- Insight Into The Organization's Culture And Unspoken Rules
- Sharing Frustrations And Successes With Someone Who Can Empathize With Where You Are In Your Career

Benefits of Mentoring for the Protégé

Novice Protégé	Seasoned Protégé
•Junior colleague	•Polished colleague
•Little/no job experience	•Extensive job experience
•Needs workplace "survival skills"	•Demonstrates work-place "survival skills"
•Needs briefings on "internal workings" and office politics	•Provides briefings on "internal workings" and office politics

When you enter into a mentoring relationship, you and your protégé become professional partners.

Benefits of Mentoring for the Organization

- Enhances Strategic Mission Initiatives
- Enhances Recruiting and Encourages Retention
- Reduces Turnover Rates
- Improves Productivity
- Enhances Professional Development
- Links Employees With Valuable Knowledge And Information With Those Employees In Need Of Such Information
- Creates A Mentoring Culture For Continued Employee Growth And Development
- Provides An Effective Mechanism For Quickly Answering Questions Or Concerns

Mentoring Models

The Tennessee Valley Chapter of Women in Defense (TVC WID) is building a dynamic **Mentor Protégé Program** that will provide **professional development and networking opportunities** in support of Women in Defense. The program is being designed in a way that recognizes and respects the needs, expectations, and life-demands of professional women and those just starting their careers.

One of the essential steps in establishing a viable program is attracting a strong group of **Mentors** to anchor the first Cohort FY11 and we are now accepting brief bio/resumes from members who want to serve and are willing to commit to the following:
•A minimum of 4 hours per month investment per Protégé (maximum of two Protégés allowed per Mentor)
•A one year commitment to the Mentoring Program
•A desire to grow professionally through Mentor-Protégé relationships

Please express your interest by submitting a half page summary about yourself to include:
•Name
•Current Position
•Brief Career History (including years of professional experience)
•Length of Time in Huntsville
•Education
•Relevant Strengths, Skills, and Interests
Why You Wish to Volunteer to be a Part of the FY11 **TVC WID Mentoring Program**

Please include your contact information and email your Bio directly to Paulette Risher at risherp@msn.com **AND** Kathy Broad at broadk@qtecinc.com no later than July 25rd. Our first year FY11 planning is underway and we are excited about the Mentoring Program being a rewarding and fun effort sustained by the diversity and leadership you bring to WID.

LinkedIn

•Contacts
•Groups
•Jbs
•Inbox (1)
•More...
Find People, Jobs, Answers, and More Search for:
Advanced

Mentors and Mentees

Mentors Helping Mentees
Mentees Helping Mentors

We all learn from each other. The main goal is to pair individuals up wth other individuals that can coach one another remotely. Please join the other site as well at mentormentee.collectivex.com so you may use the discussion groups.

About this Group About this Group
•**Created:** June 3, 2008
•**Type:** Networking Group
•**Members:** 75
•**Subgroups:** 2
•**Owner:** John M.
•**Managers:** Pat DeLassus
•**Website:** http://mentormentee.collectivex.com

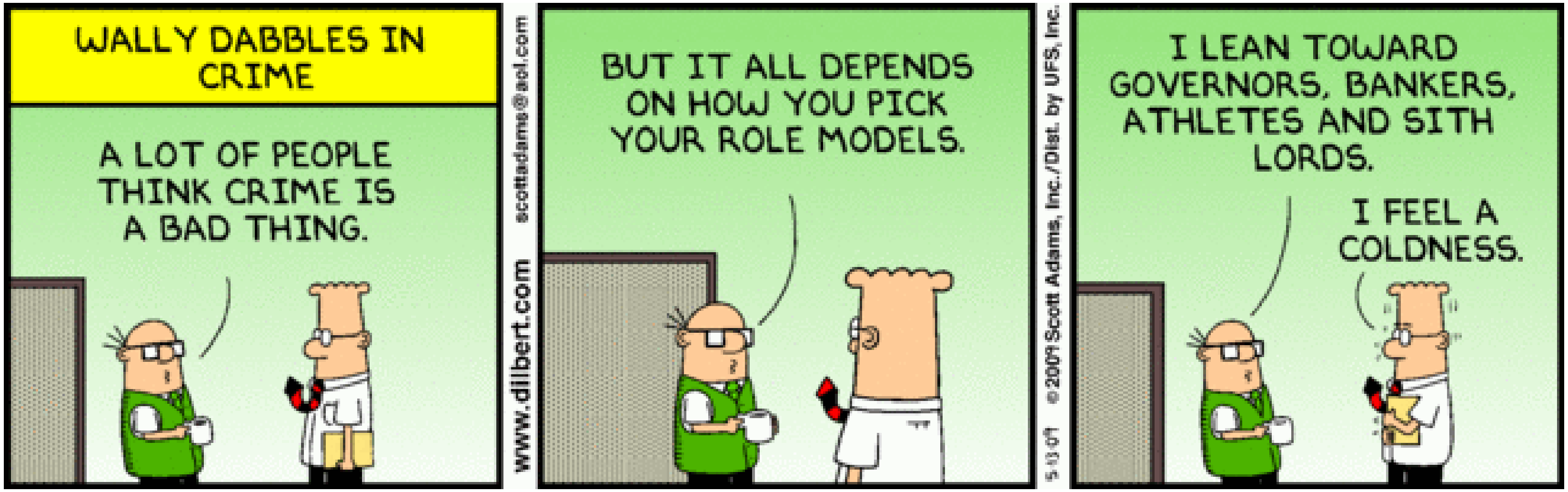
Subgroups
•**Helping a Small Business Owner**
•4 members | Forward | Join
•**Technology**
•1 member | Forward | Join

Mentoring Models (cont'd)

- Traditional Mentor-protégé Relationship
- E-mentoring
- Another Model Allows The Mentor To Be A Referral Person, Not The Person With All Of The Answers
- Self-Mentoring

DILBERT: (c) Scott Adams/Dist. by United Feature Syndicate, Inc.

Matching Mentor with Protégé



DILBERT: (c) Scott Adams/Dist. by United Feature Syndicate, Inc.

Matching Mentor with Protégé

- **Match Mentors And Protégés; Areas To Consider Are:**
  - The Available And Willing Mentors
  - Mentor And Protégés' Strengths And Weaknesses
  - Learning Styles
  - Goals Of The Organization/Agency Or The Mentor Program

"Matching is, without a doubt, the single most critical success factor to a formal corporate mentoring program". – Deb Bauer, Program Managers of Dell's Global Diversity Department

Matching Mentor with Protégé

CNN World News
August 25th, 2010
10:20 AM ET

Mentoring session turns into a shootout

Two coalition service members, an Afghan police officer and one civilian were killed in western Afghanistan on Wednesday when a mentoring session turned into a shootout, military officials said.

Officials with NATO's International Security Assistance Force were trying to determine what caused the shooting.

The shooting apparently happened during a mentoring session between coalition soldiers and the Afghan national police, coalition officials said in a statement.

During the mentoring session, an Afghan officer began firing a gun and the coalition soldiers returned fire, the statement said.

The incident, which occurred in the Badghis province, was followed by a demonstration by locals in the area, according to the statement.

Tips for Mentors

- **The First Session Should Take Place In Person, But May Be Conducted By E-mail Or On The Telephone**
- **A Face-to-Face Meeting Should Be In A Neutral Setting Without Distractions Or Interruptions.**
- **Discuss The Protégé's Expectations.**
  - Where Do You Want Your Career To Go?
  - Develop A Meeting Schedule With Your Protégé

Tips for Mentors

- Listen, Counsel, Coach, Advise On Career And Goal Setting To Help Protégé Develop Individual Career Development Plan
- Evaluate Each Meeting With The Protégé
- Most Mentor Research Describes That 90 Percent Of The Mentor-Protégé Relationships Work Out Well
- When Developing A Mentor Program, The Organization/Agency Should Address How A Mentor And Protégé Pairing That Is Not Successful Will Be Handled
- Conclude The Mentoring Process When Appropriate

DILBERT: (c) Scott Adams/Dist. by United Feature Syndicate, Inc.

BREAK

Seven Mentoring Fundamentals

#1: Mentoring Takes Place Outside of a Manager-Employee Relationship, at the Mutual Consent of Mentor and Protégé.

Seven Mentoring Fundamentals

#2: Mentoring is Career-Focused or Focuses on Professional Development that may be Outside a Protégé's Area of Work.

Focus on Professional Development

DILBERT: (c) Scott Adams/Dist. by United Feature Syndicate, Inc.

Seven Mentoring Fundamentals

#3: The Mentorship Relationship is Personal and Confidential; A Mentor Provides Both Professional and Personal Support.

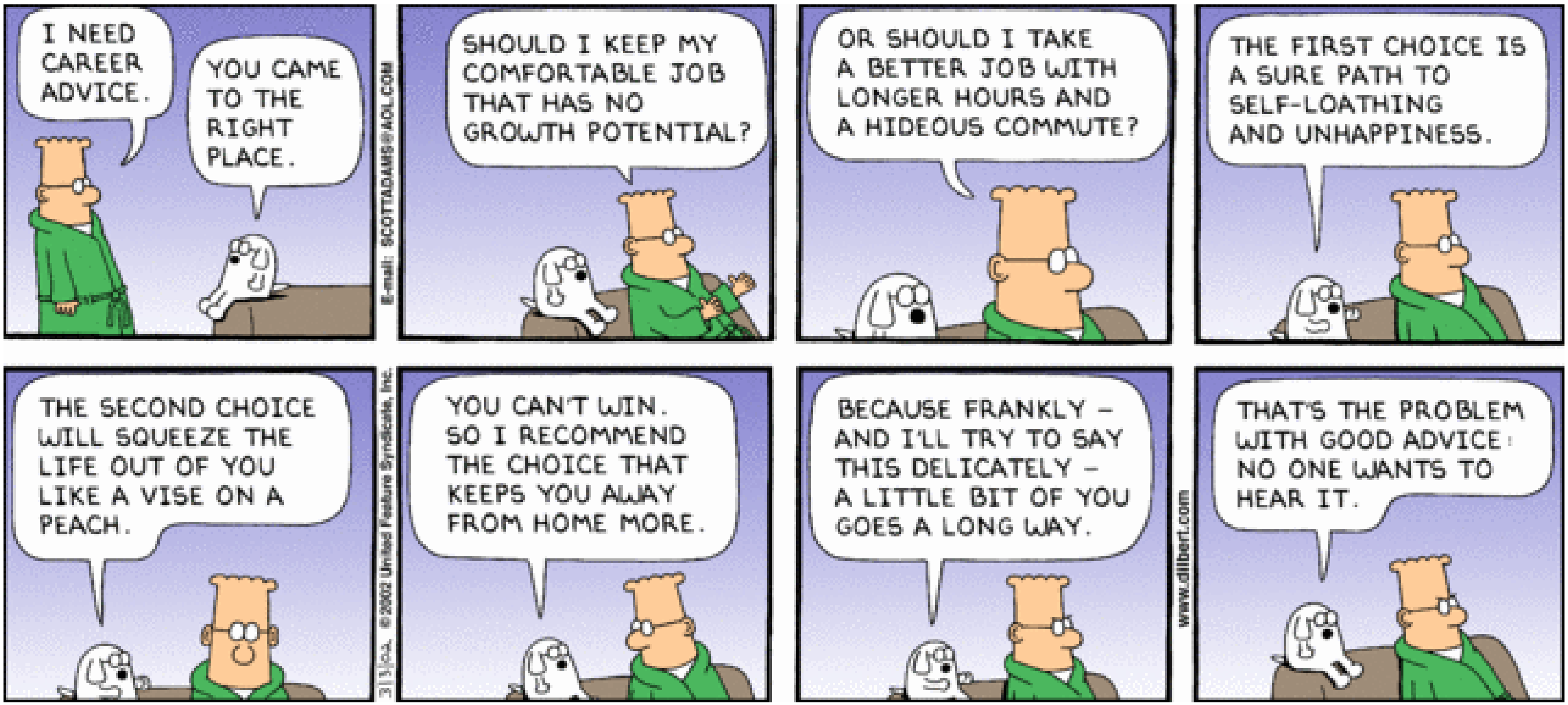
Seven Mentoring Fundamentals

#4: The Mentorship Relationship Crosses Job Boundaries.

Seven Mentoring Fundamentals

#5: A Mentor Will Identify the Protégé's Unique Skills and Capabilities and Work With Him/Her to Make the Most of Those Talents.

Identify the Protégé's Unique Skills and Capabilities



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Seven Mentoring Fundamentals

#6: A Mentor Helps a Protégé Better Understand How the Organization Works (Those Aspects of the Organization that Aren't Written Down)

Seven Mentoring Fundamentals

#7: A Mentor Should Communicate Professional and Organizational Values

Poor Mentoring Practices

- Canceling Appointments
- Not Providing Opportunities For The Protégé To Observe Work In Progress
- Disparaging The Organization/Agency's Processes, Procedures, Or Politics
- Mentor Tyranny, Manipulation or Politicking
- Bad Protégé Actions

Summary

- Give the Mentor-Protégé Relationship Structure
- Recruit Carefully
- Provide Protégé Training & Orientation
- Define Expectations Up Front
- Give Feedback
- Prepare for the End
- Benefit The Mentor, Protégé And The Organization

As The Protégé Grows Professionally, The Amount Of Dependence Decreases, Until The Protégé Is Shaped Into An Independent And Competent Employee.

For Additional Information

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NDIA
SYSTEM
ENGINEERING
CONFERENCE

JOG SYSTEM ENGINEERING
GRAND SYSTEMS DEVELOPMENT TRAINING PROGRAM
TUTORIAL

UNIVERSAL ARCHITECTURE DESCRIPTION FRAMEWORK

INTRODUCTION

Presented By
Jeffrey O. Grady
President JOG System Engineering
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San Diego, CA 92122
(858) 458-0121
jeff@jogse.com   jgrady@ucsd.edu

Who Is Jeff Grady?

CURRENT POSITION

President, JOG System Engineering, Inc.
System Engineering Assessment, Consulting, and Education Firm

PRIOR EXPERIENCE

1954 -1964 U.S. Marines

1964 - 1965 General Precision, Librascope Div
- Customer Training Instructor, SUBROC and ASROC ASW Systems

1965 - 1982 Teledyne Ryan Aeronautical
- Field Engineer, AQM-34 Series Special Purpose Aircraft
- Project Engineer, System Engineer, Unmanned Aircraft Systems

1982 - 1984 General Dynamics Convair Division
- System and Group Engineer, Cruise Missile, Advanced Cruise Missile

1984 - 1993 General Dynamics Space Systems Division
- Functional Engineering Chief & Manager of Systems Development

FORMAL EDUCATION

SDSU, BA Math; UCSD, Systems Engineering Certificate;
USC, MS Systems Management with Information Systems Certificate

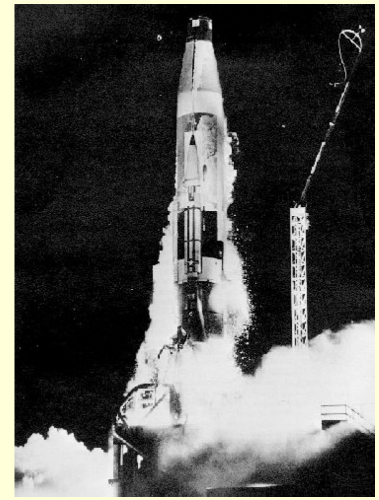
INCOSE First Elected Secretary, Fellow, Founder, Expert System Engineering Professional

AUTHOR System Requirements Analysis (2), System Verification, System Integration, System Validation and Verification, System Engineering Planning and Enterprise Identity, System Engineering Deployment, System Synthesis, System Management

Systems Jeff Grady Worked On

USN/Librascope
ASROC/SUBROC
Computer Systems

USAF/GD Convair AQM 129
Advanced Cruise Missile



USAF/GD Atlas Missile

USAF/Ryan AQM-81 Firebolt 1983

Ryan Aeronautical War Birds

USAF/Ryan Models 147G, NX, H, and J at Bien Hoa, SVN in 1968

USAF/Ryan AQM-34L Tom Cat
58 Combat Missions

U.S. Navy/Ryan
Model 147SK

USAF/Ryan
BGM-34C

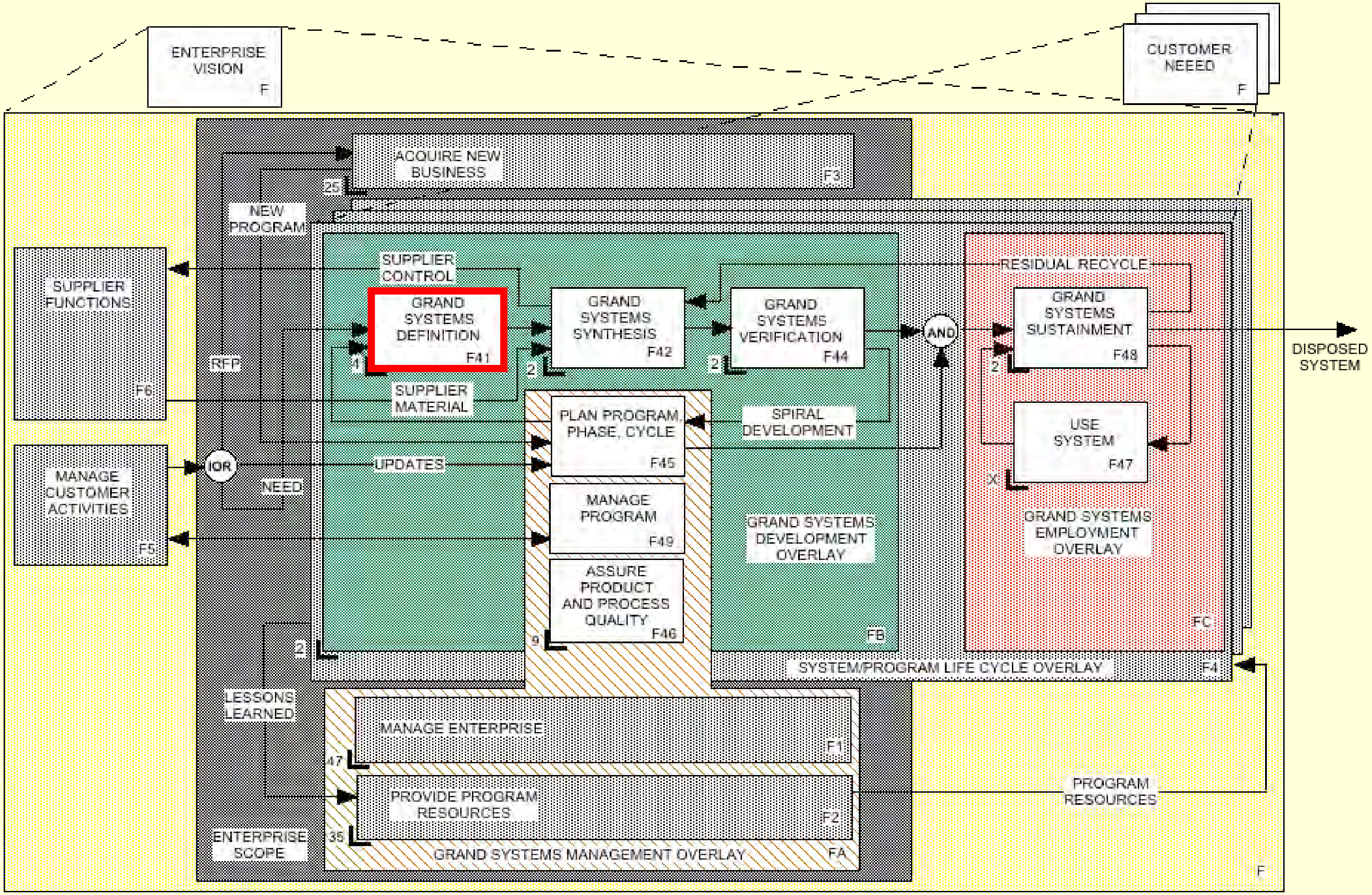
Who is Attending?

- **Small class**
  - **Name**
  - **Place of employment**
  - **Modeling and requirements experience**
- **Large class**
  - **At first break engage in conversation with someone you did not know when arriving for class**
  - **Discuss modeling and requirements work**

Tutorial Outline

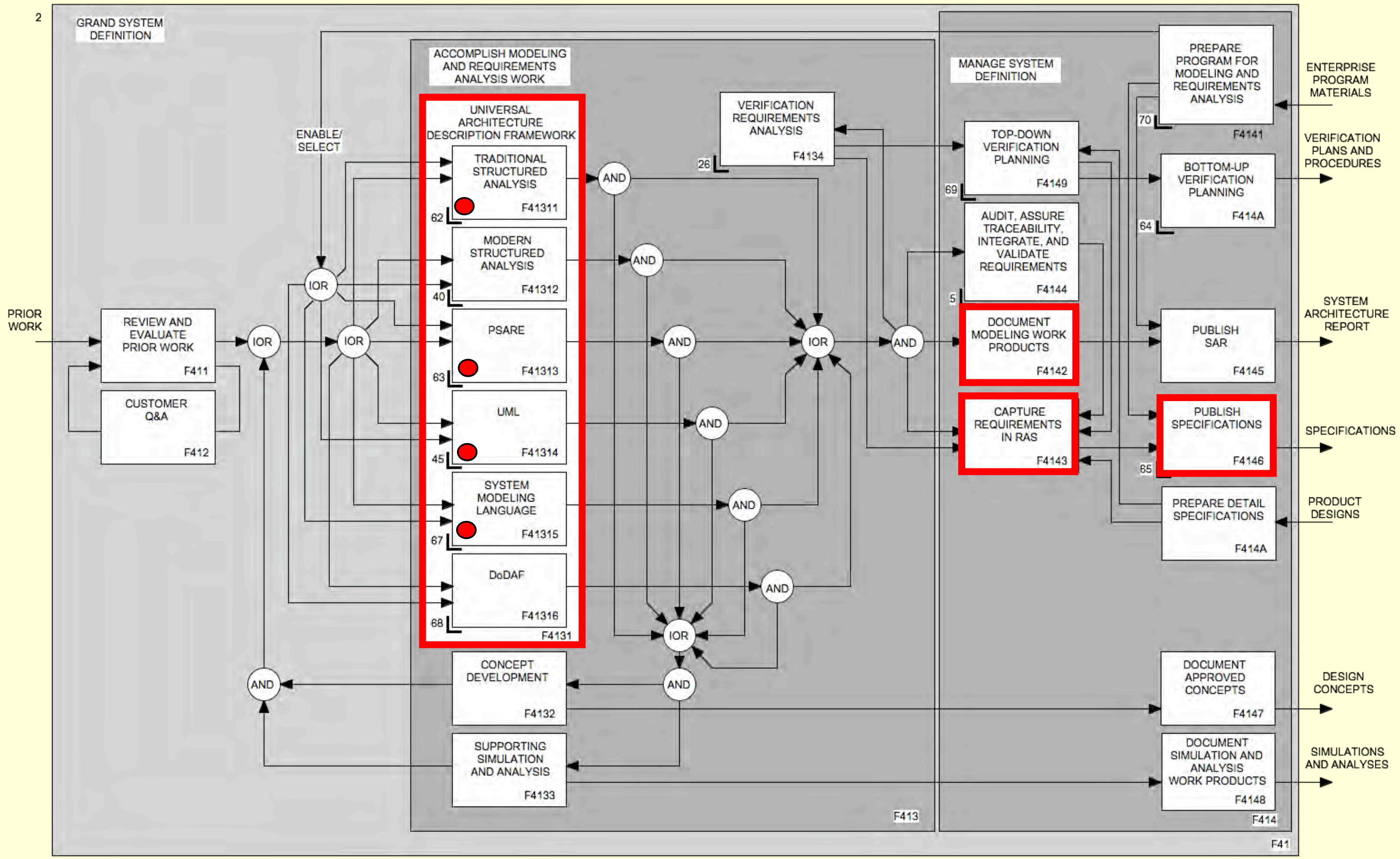
1. Introduction
2. Traditional structured analysis overview
3. MSA/PSARE modeling overview and UADF construct
4. UML/SysML modeling overview and UADF construct
5. The future

Enterprise Common Procss



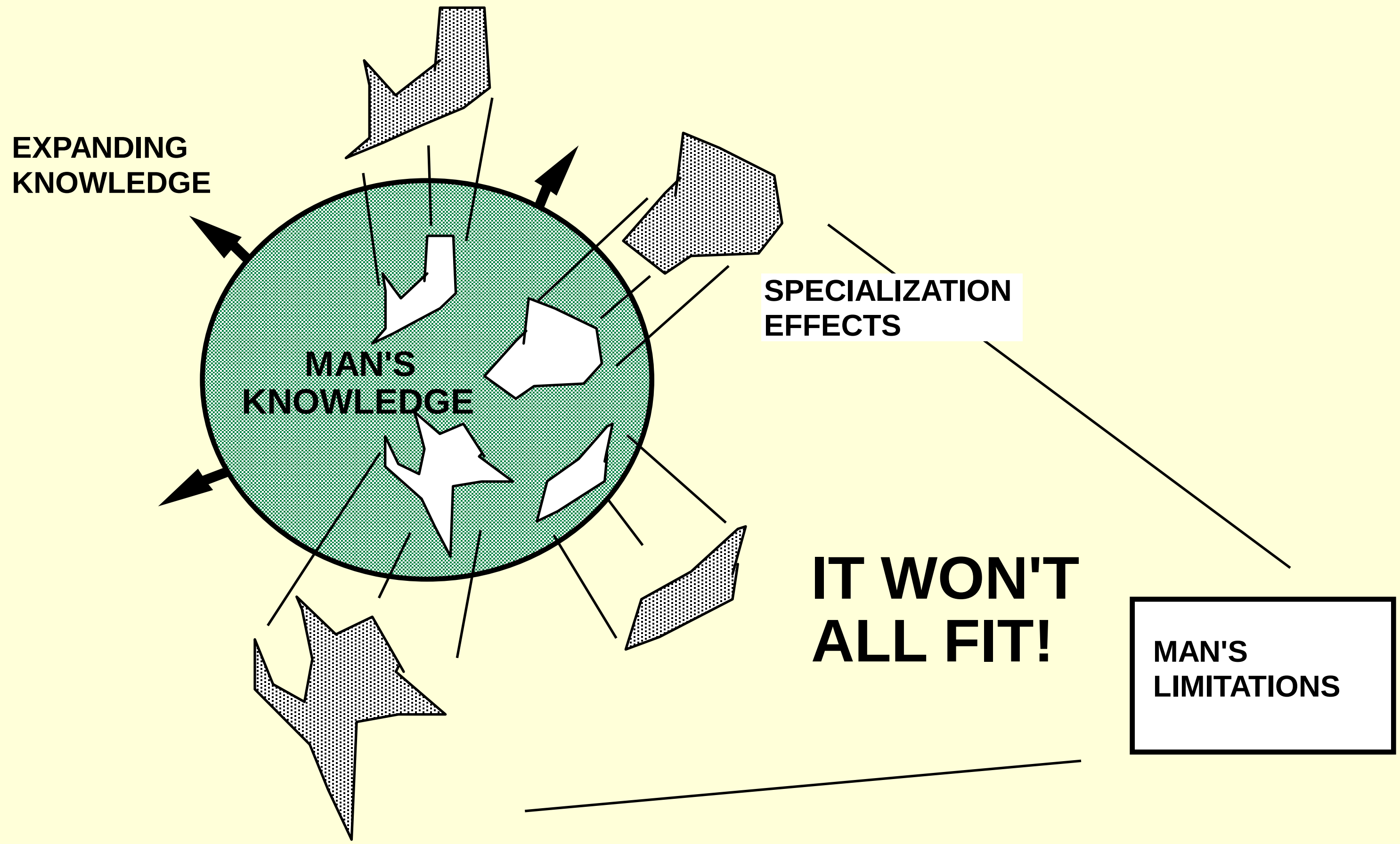
X: REFER TO PROGRAM SYSTEM DEFINITION DOCUMENT FOR EXPANSION

Common Process Areas of Interest



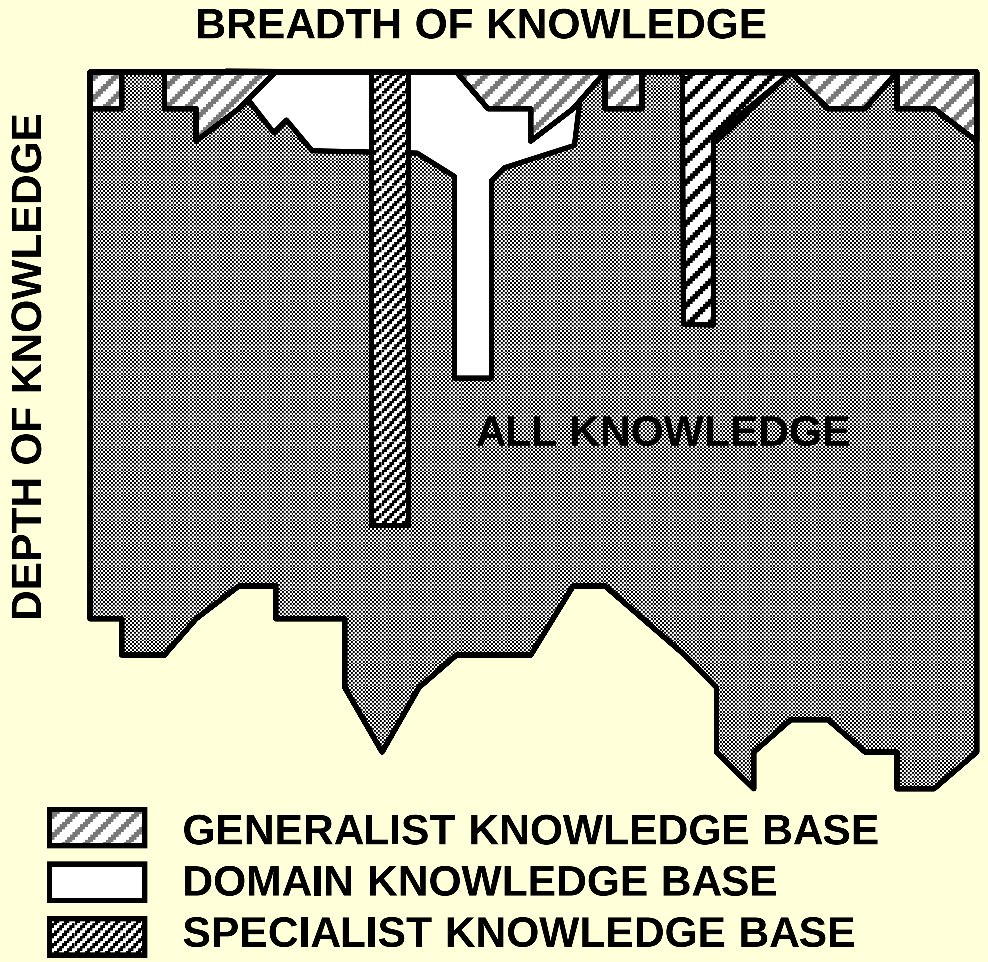
The Foundation of System Engineering

Knowledge Grows & We Have Our Limitations



We Are All Specialists

Systems Are Developed by People Sharing Knowledge



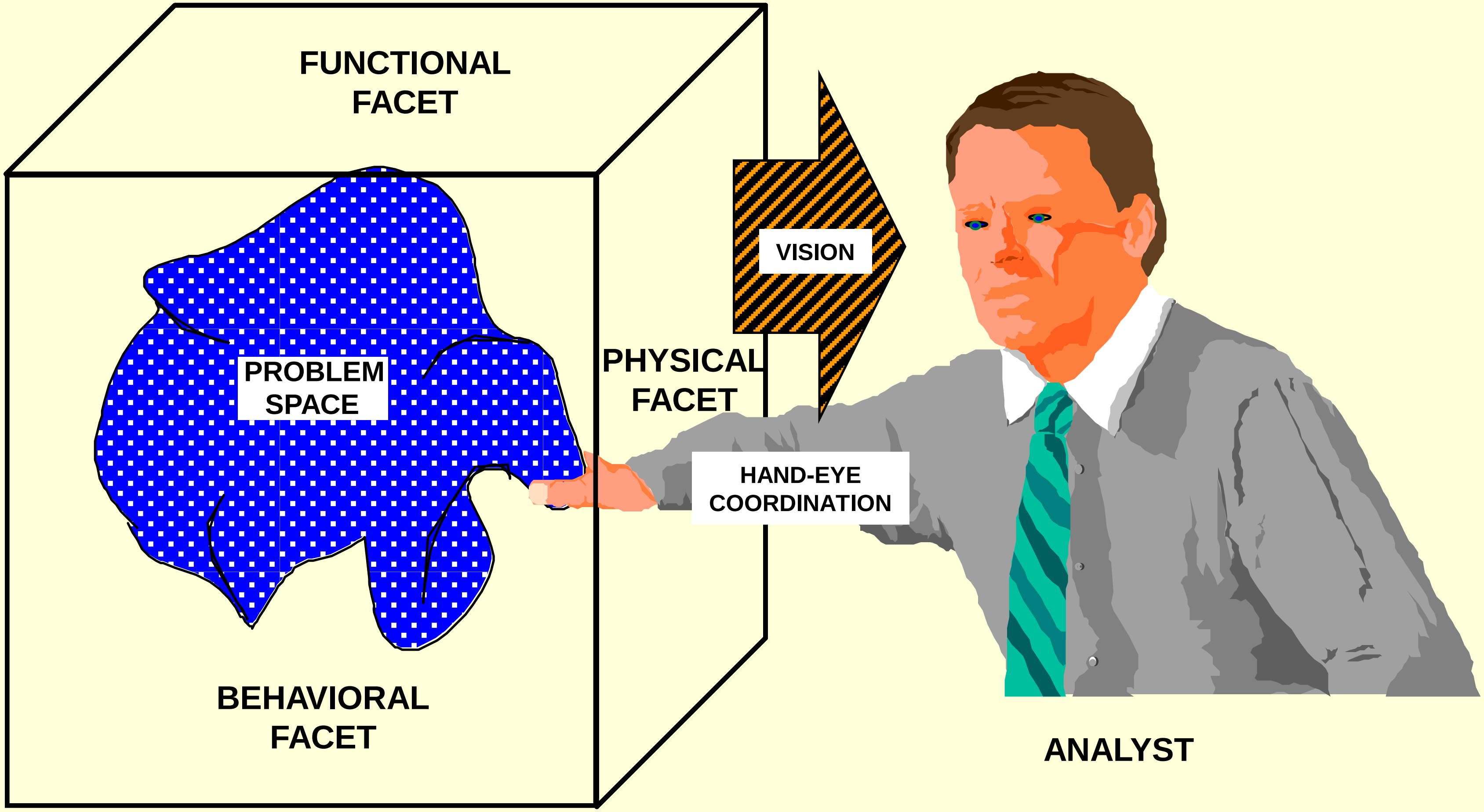
Models Support Information Sharing During Early Development

- When developing an unprecedented system it is helpful to model it as a way of learning more about it
- We have no reality to observe in the beginning so we must model

Bran Selic's Model Characteristics

- The use of abstraction to emphasize important aspects while removing irrelevant ones.
- Expressed in a form that is really understandable by observers.
- Fully and accurately represents the modeled system.
- Predictive such that it can be used to derive correct conclusions about the modeled system.
- Inexpensive meaning it is much cheaper to construct and study than simply building and observing the modeled system.

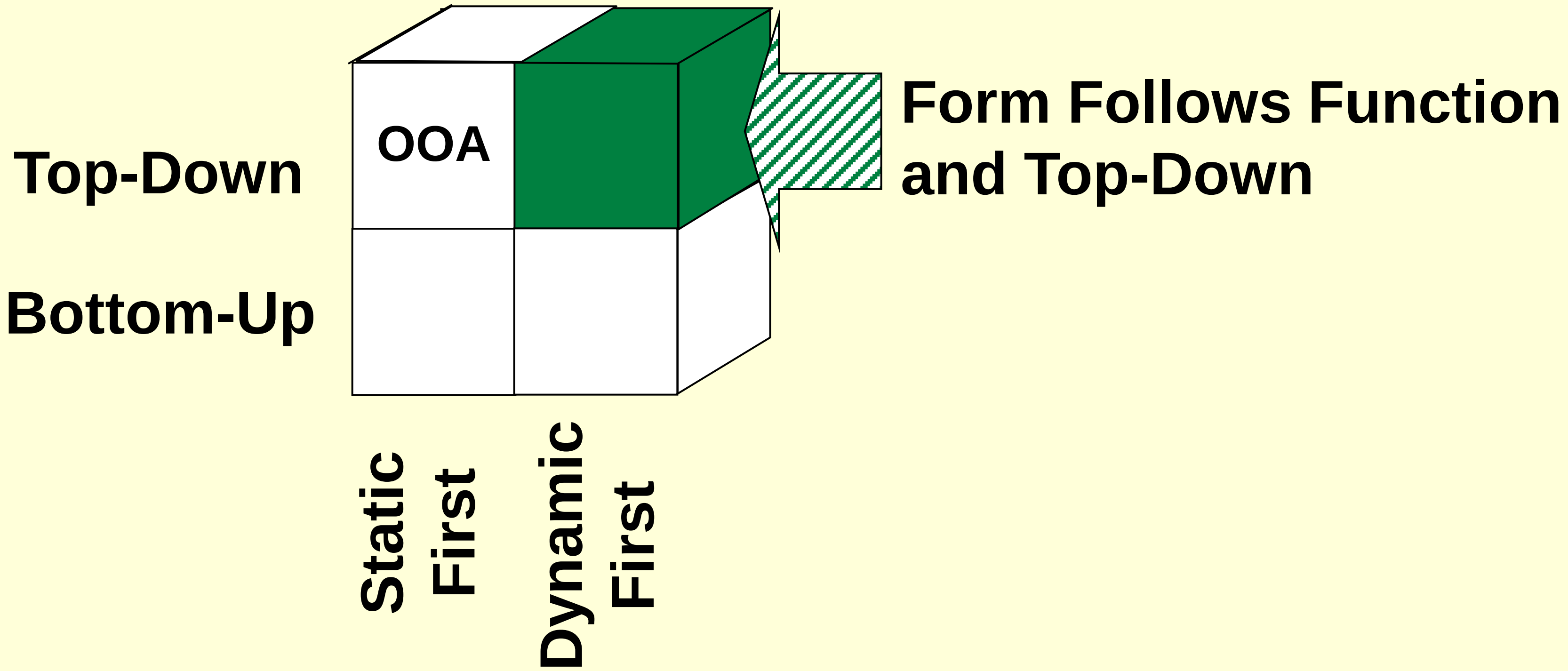
We Apply Models For Good Reasons



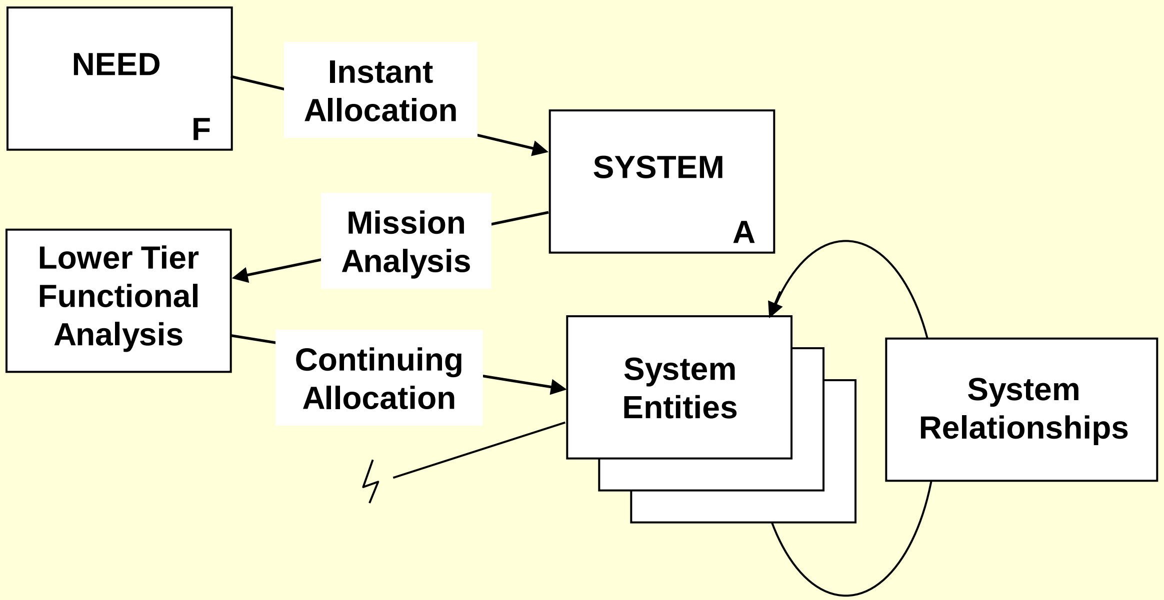
Visual Complexity Continuum
Some Models Are Richer Than Others

- Some models are visually simple like functional flow diagramming
  - Ideas flow readily from model into the human mind through vision because of the simple graphics
  - Not a very rich story comes through
- Other models are more visually complex like IDEF-0, EFFBD, DoDAF
  - The picture does not transfer so easily into the mind visually
  - DoDAF includes 26 different artfacts
  - But it conveys a very rich story when it gets there

Modeling Sequencing



Which Comes First?



Clearly the functionality

Architecture First Counter-Argument

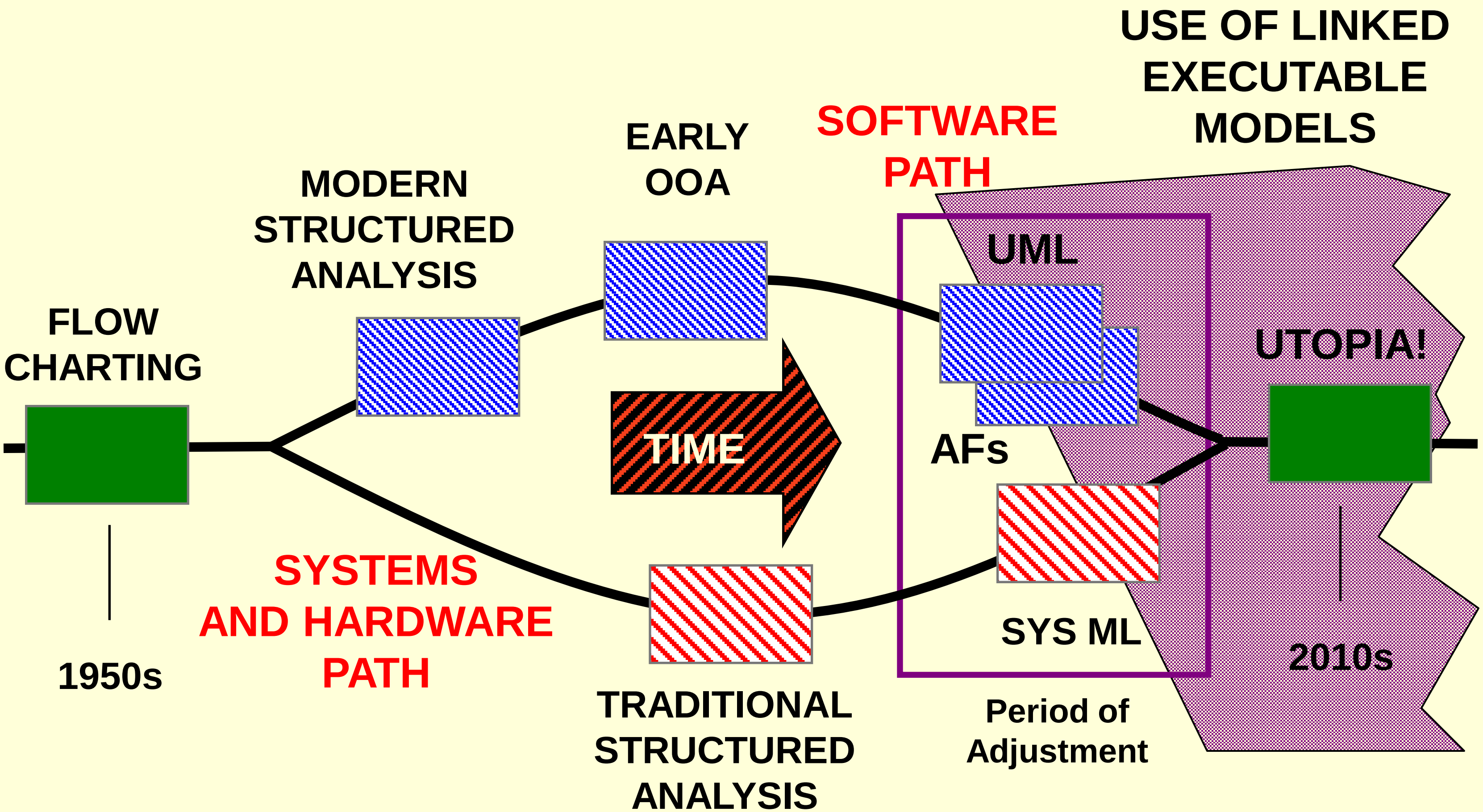
- Early OOA authors all supported object entry into the problem space with DFD and state machine examination of objects
- Exactly opposite to Sullivan's idea of form follows function
- Murray Cantor's "Thoughts on Functional Decomposition" in The Rational Edge offers the best printed argument for this approach
- Principal argument seems to be that multiple lower tier alternative solutions will appear in the product but this is a failure of lower tier system integration and optimization and the standard PMP concept can be employed with software as well as hardware

Model Orientation Relative to Dynamic and Static Components

	STATIC COMPONENT	DYNAMIC COMPONENTS	
MULTI-FACETED MODELS	PRODUCT ENTITY FACET	FUNCTIONAL FACET	BEHAVIOR FACET
TRADITIONAL STRUCTURED ANALYSIS	ARCHITECTURE BLOCK DIAGRAM	FUNCTIONAL FLOW DIAGRAM ●	SCHEMATIC BLOCK DIAGRAM
MODERN STRUCTURED ANALYSIS AND HP	HIERARCHICAL DIAGRAM	DATA FLOW DIAGRAM ●	P SPEC, STATE DIAGRAM
EARLY OBJECT-ORIENTED ANALYSIS	CLASS AND OBJECT DIAGRAM ●	DATA FLOW DIAGRAM	STATE DIAGRAM
UML VARIATION OF OOA	CLASS AND OBJECT DIAGRAM, COMPONENT DIAGRAM, AND DEPLOY-MENT DIAGRAM	USE CASES AND ACTIVITY DIAGRAM ●	SEQUENCE DIAGRAM, STATECHART, AND COMMUNICATION DIAGRAM
SysML	BLOCK DIAGRAMS	USE CASES AMD ACTVITY DIAGRAM ●	SEQUENCE DIAGRAM AND STATECHART

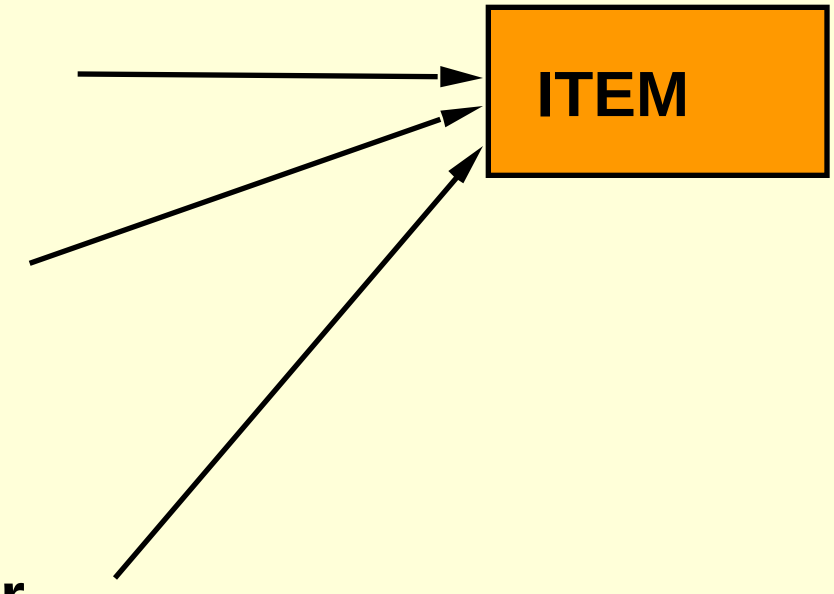
● ANALYTICAL ENTRY FACET

The History of Requirements Modeling



The First Objective of Modeling - Requirements Identification

- **Something wanted or necessary.**
- **Something essential to the existence or occurrence of something else.**
- **A necessary character-istic or attribute of some thing (or item).**



Requirement Types

- **System composition**
  - What does the system consist on in terms of entities?
  - What relationships (interfaces) must exist between them?
- **Entity and relationship essential characteristics**
  - Performance (Functional)
    - What does it have to do and how well does it have to do it?
  - Design constraints (Non-functional)
    - Boundary conditions that the design team must remain within while satisfying performance requirements of three kinds
      - Interface
      - Specialty Engineering/Quality
      - Environmental

Writing Requirements is not Difficult

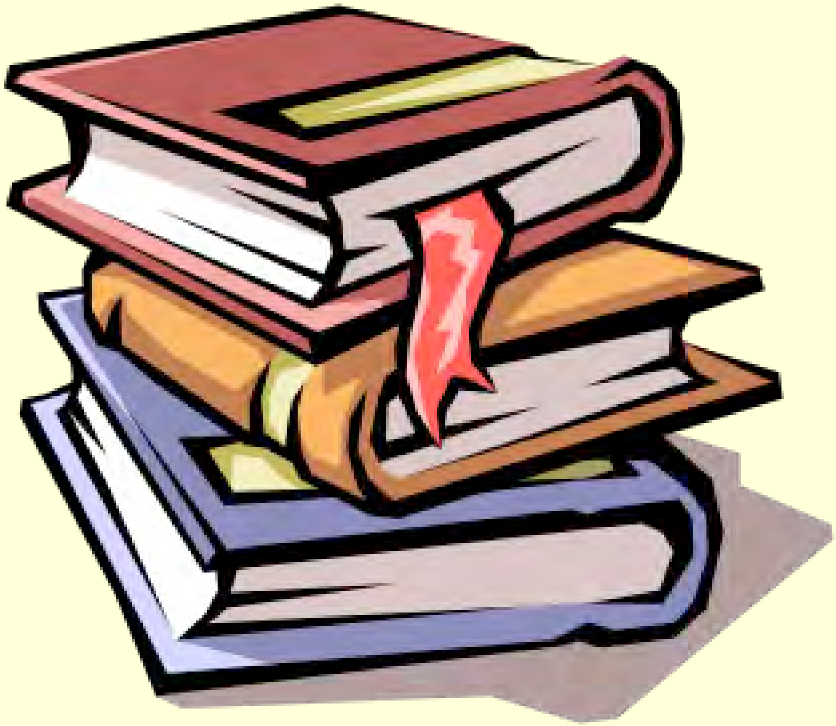
- The hard job is
  - Knowing what to write them about and
  - Determining numerical values that should be in them
- Thus we use models to gain insight into the essential characteristics
  - The models are composed of simple graphics
  - Model symbols (lines, block, bubbles, ...) relate to requirements that are derived from the model
  - The models encourage completeness and avoidance of unnecessary content
  - Models focus our human thought processes
- And good engineering to determine appropriate values

Requirement Primitive Form

- The subject identifies the attribute that must be controlled
- A form of the verb shall shows the degree of determination that the design must possess a capability.
- The remainder of the sentence provides a value and the relationship between the value and the attribute.
- In primitive form:

Speed $\geq$ 695 knots

What is a Specification?

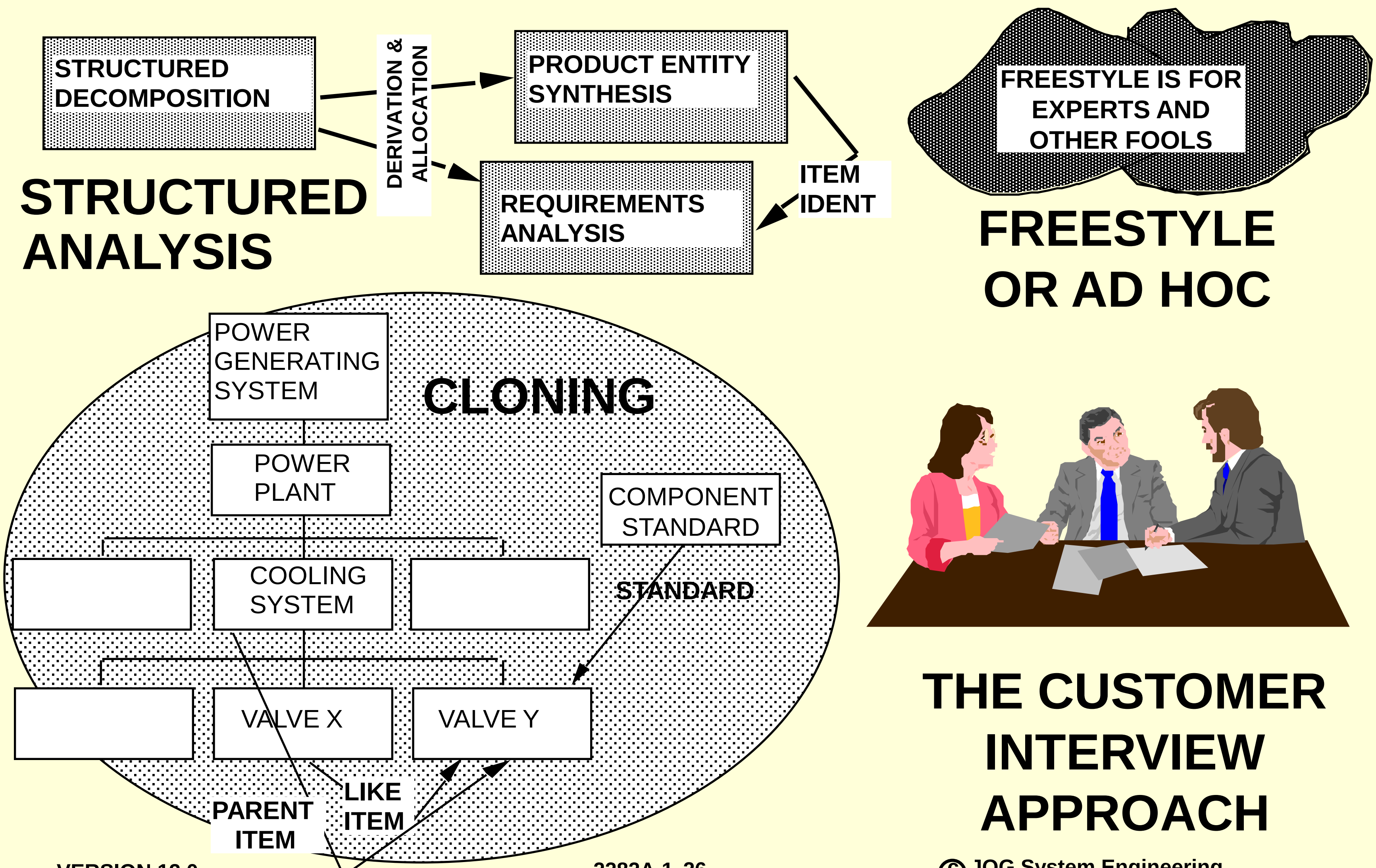


A specification is a document that contains all of the essential characteristics for a given item.

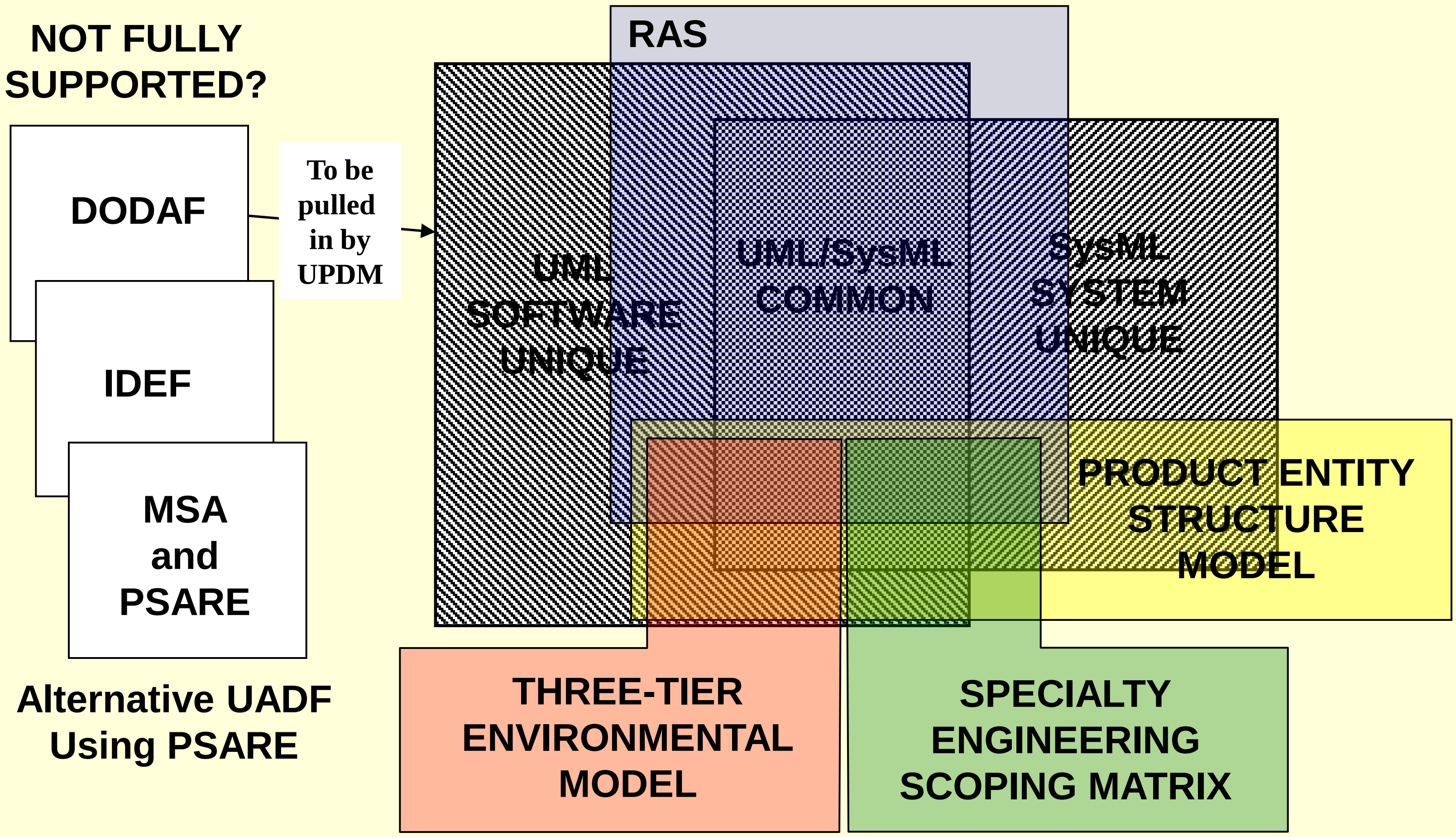
Must it be a paper document?

In Writing a Specification, What Is the Target?

Requirements Derivation Strategies



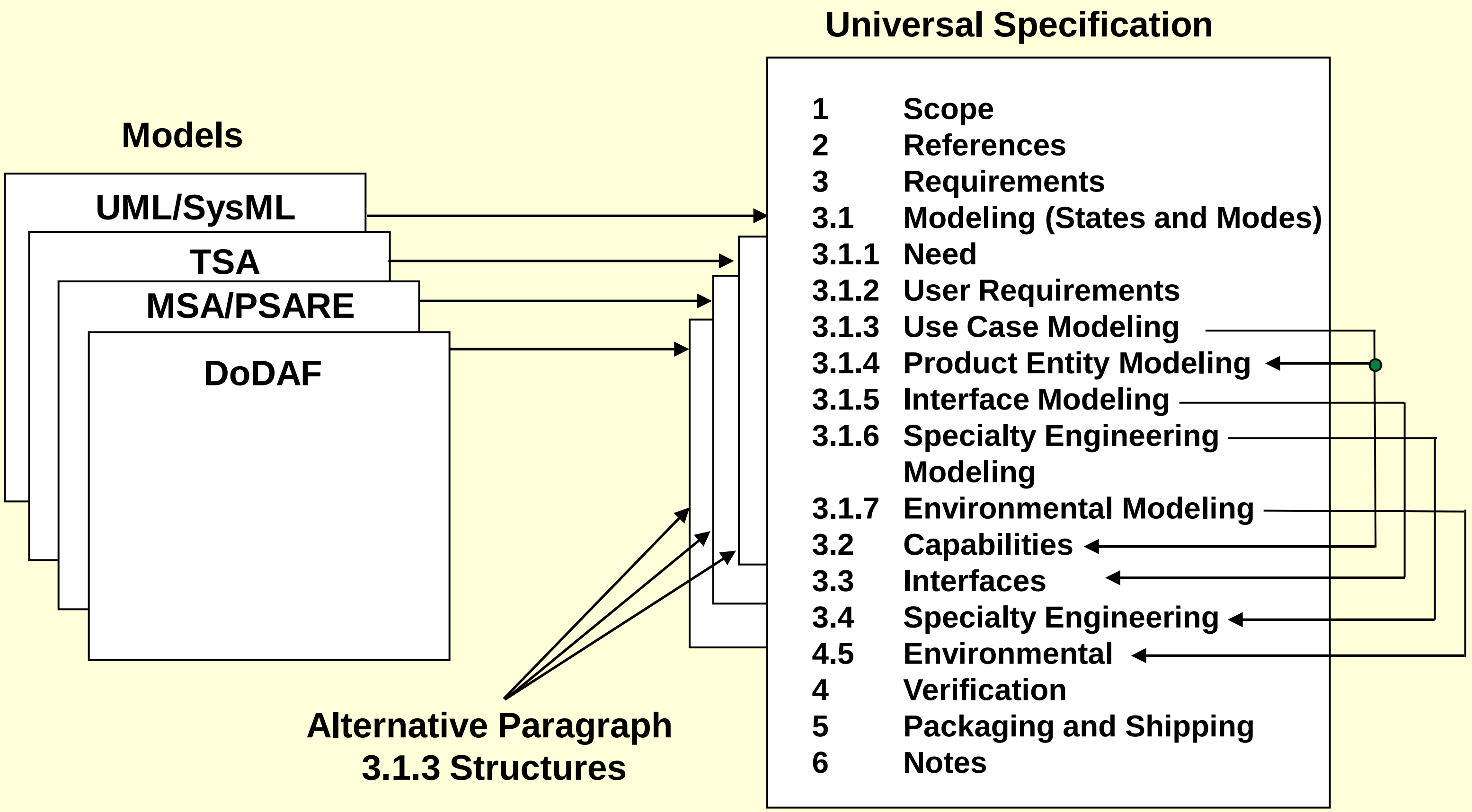
A Universal Model for the Future?



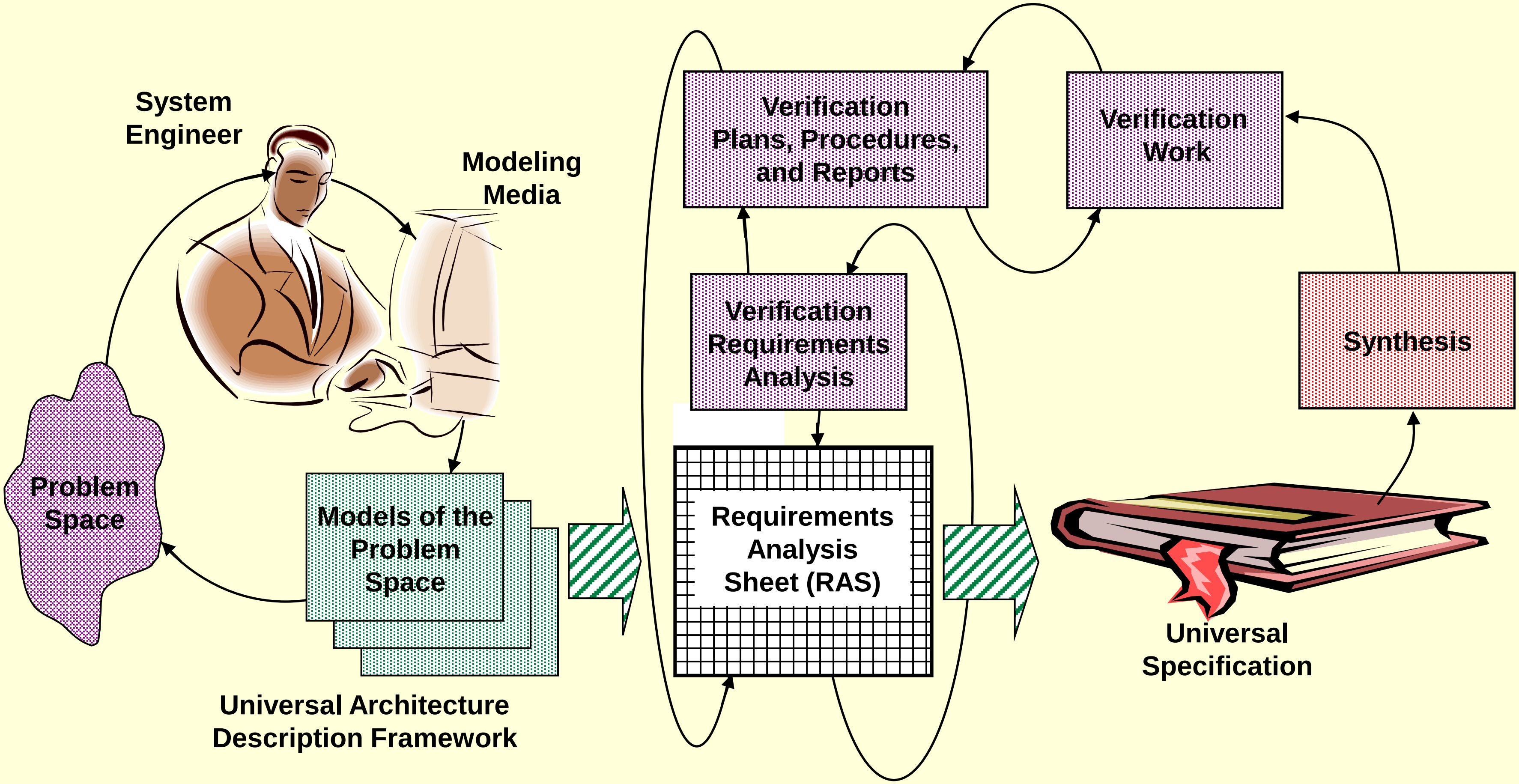
UADF Modeling Artifacts Summary

		UNIVERSAL ARCHITECTURE DESCRIPRION FRAMEWORKS			
		FUNCTIONAL	MSA-PSARE	UML-SYSML	
PRODUCT ENTITY DEFINITION		ALLOCATION	SUPPER BUBBLES	SEQ DIAGRAM LIFE LINES OR ACTIVITY DIAG SWIM LANES	
PRODUCT ENTITY REQUIREMENTS	PERFORMANCE REQUIREMENTS	FLOW DIAGRAMS, IDEF-0, BEHAVIOR DIAGRAMS, OR ENHANCED FFBD	DFD/CFD, P-SPEC, C-SPEC, AND DATA DICTONARY	USE CASE, SEQUENCE, ACTIVITY, AND STATE DIAGRAMS	
	INTERFACE REQUIREMENTS	N-SQUARE AND SCHEMATIC BLOCK DIAGRAM	DIRECTED LINE SEGMENTS THAT CROSS SUPER BUBBLE BOUNDARIES	DIRECTED LINE SEGMENTS THAT JOIN LIFE LINES	
	SPECIALTY ENGINEERING REQUIREMENTS	SPECIALTY ENGINEERING SCOPING MATRIX	SPECIALTY ENGINEERING SCOPING MATRIX	SPECIALTY ENGINEERING SCOPING MATRIX	CONSTRAINTS MODELING EXTENSION
	ENVIRONMENTAL REQUIREMENTS	THREE-LAYER MODEL	THREE-LAYER MODEL	THREE-LAYER MODEL	
SOLUTION SPACE MODELS		PRODUCT ENTITY BLOCK AND SCHEMATIC BLOCK DIAGRAM	ARCHITECTURE MODEL	CLASS/OBJECT DIAGRAM, COMPONENT DIAGRAM, DEPLOYMENT DIAGRAM, BLOCK DEFINITION DIAGRAM, AND INTERNAL BLOCK DIAGRAM	

Model Results Flow Into Specification Content



Development Life Cycle Overview
From a Universal Architecture Perspective



JOG SYSTEM ENGINEERING
GRAND SYSTEMS DEVELOPMENT TRAINING PROGRAM
TUTORIAL

UNIVERSAL ARCHITECTURE DESCRIPTION FRAMEWORK

TRADITIONAL STRUCTURED ANALYSIS OVERVIEW

Hardware and Systems Analysis Models

- Traditional structured analysis
  - Functional analysis
    - Functional flow diagramming
    - Enhanced functional flow diagramming, used in CORE
    - Behavioral diagramming, used in RDD-100 derived from IPO
    - IDEF 0 derived from SADT
    - Process flow analysis
    - Hierarchical functional analysis
    - FRAT
  - State diagramming
  - Specialty engineering scoping and discipline-specific modeling
  - Three-tier environmental requirements construct
  - Product entity structure
  - Requirements analysis sheet
- SysML

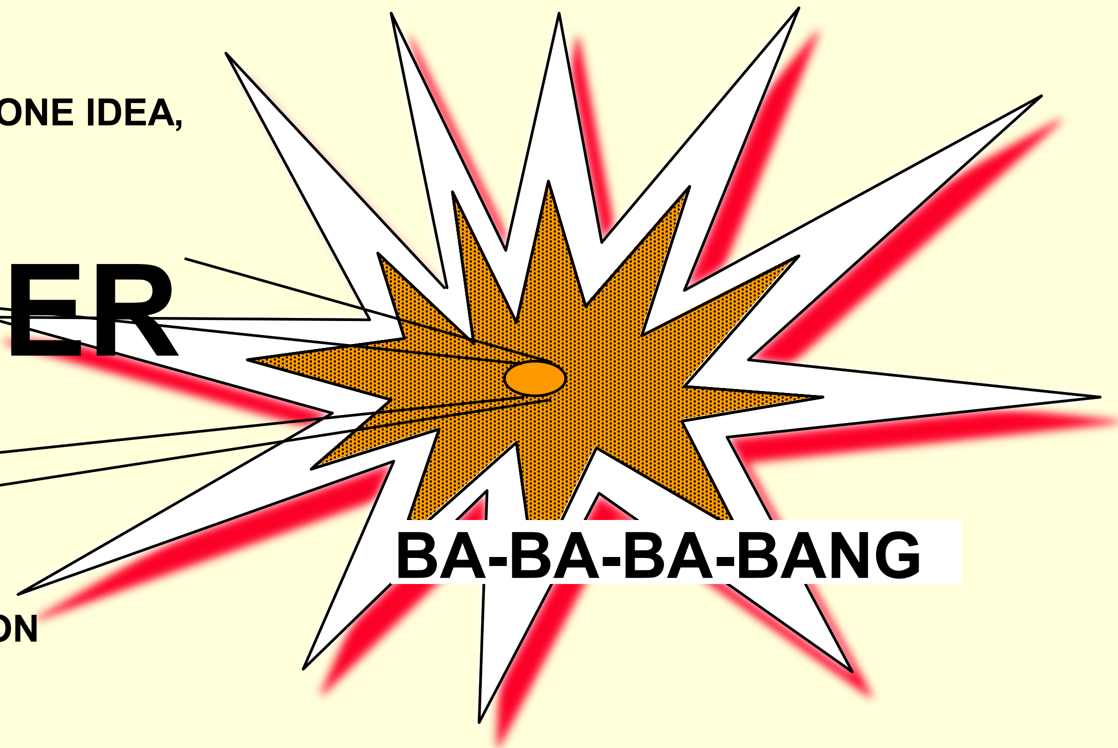
The Big Bang Theory Of System Development

THE TRADITIONAL SRA APPROACH

EVERYTHING FLOWS FROM ONE IDEA,

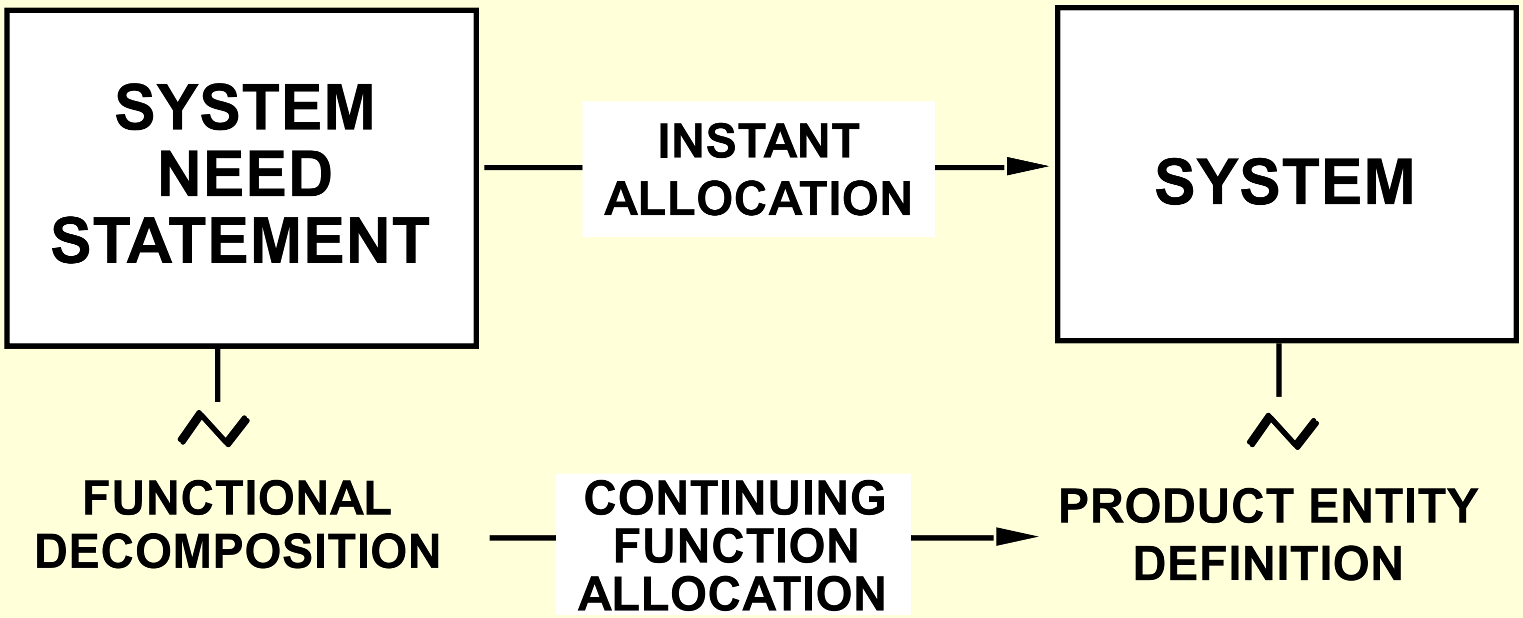
THE

CUSTOMER NEED

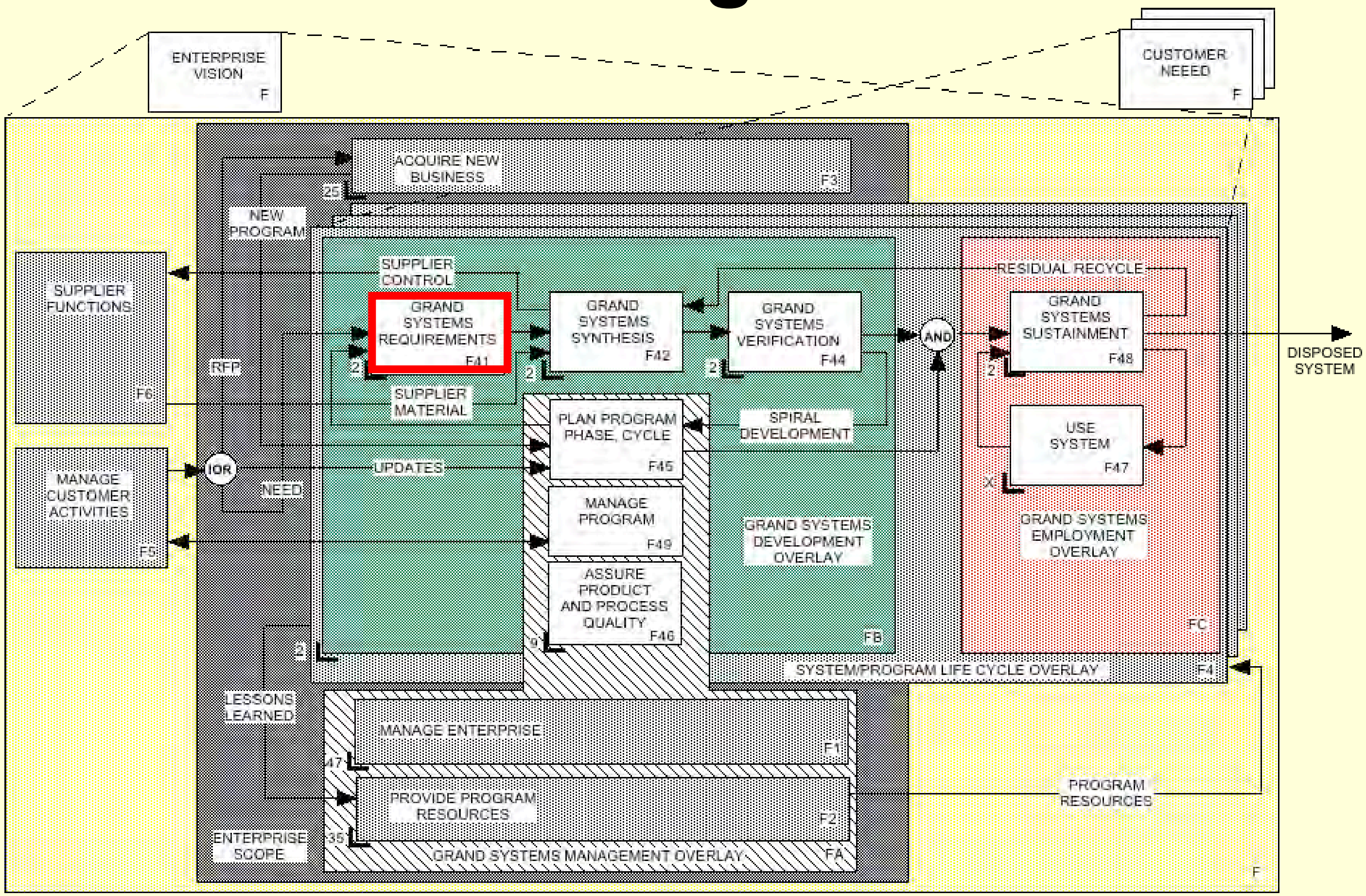


THE ULTIMATE FUNCTION

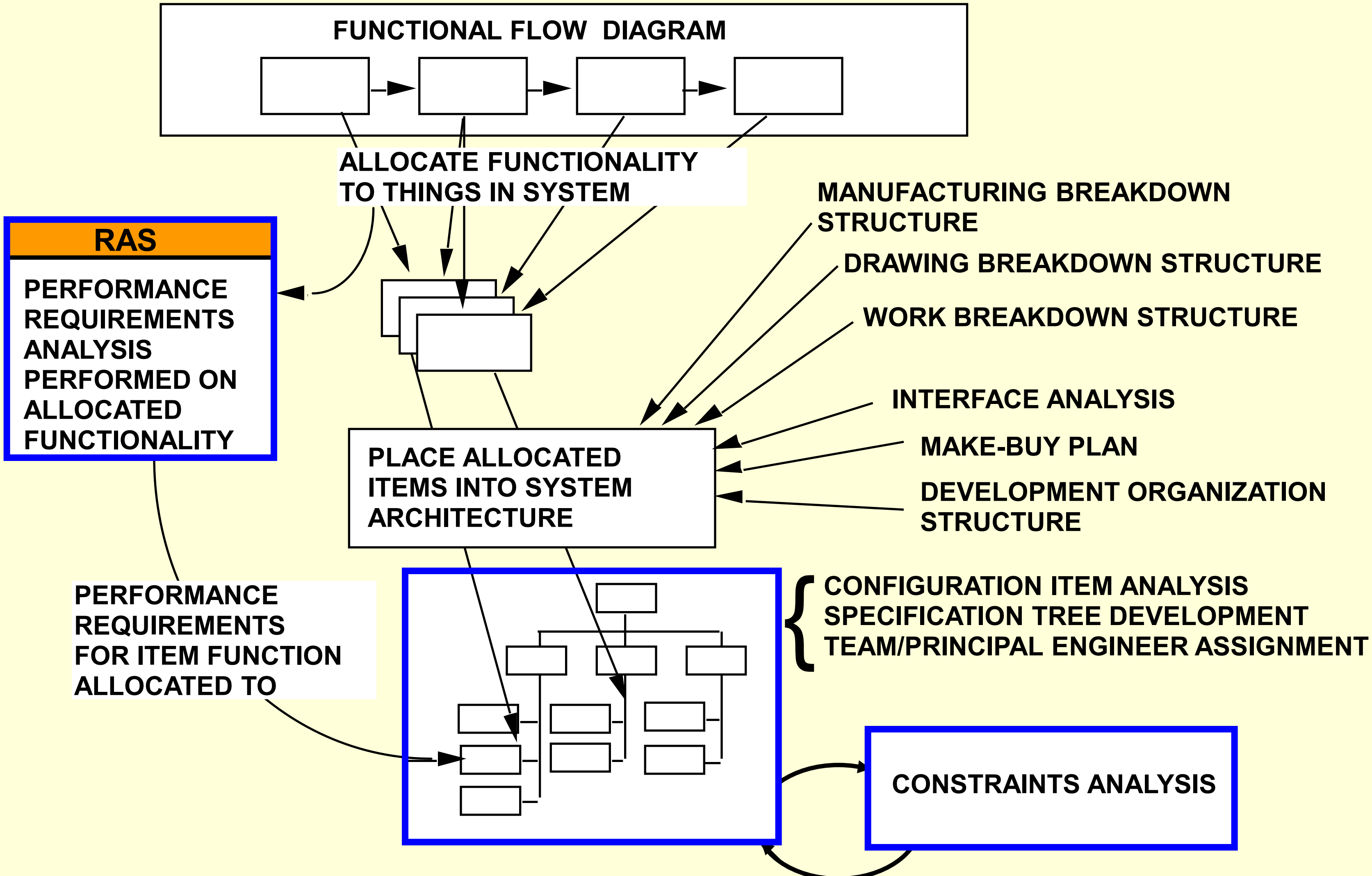
The Beginning of Functional Decomposition



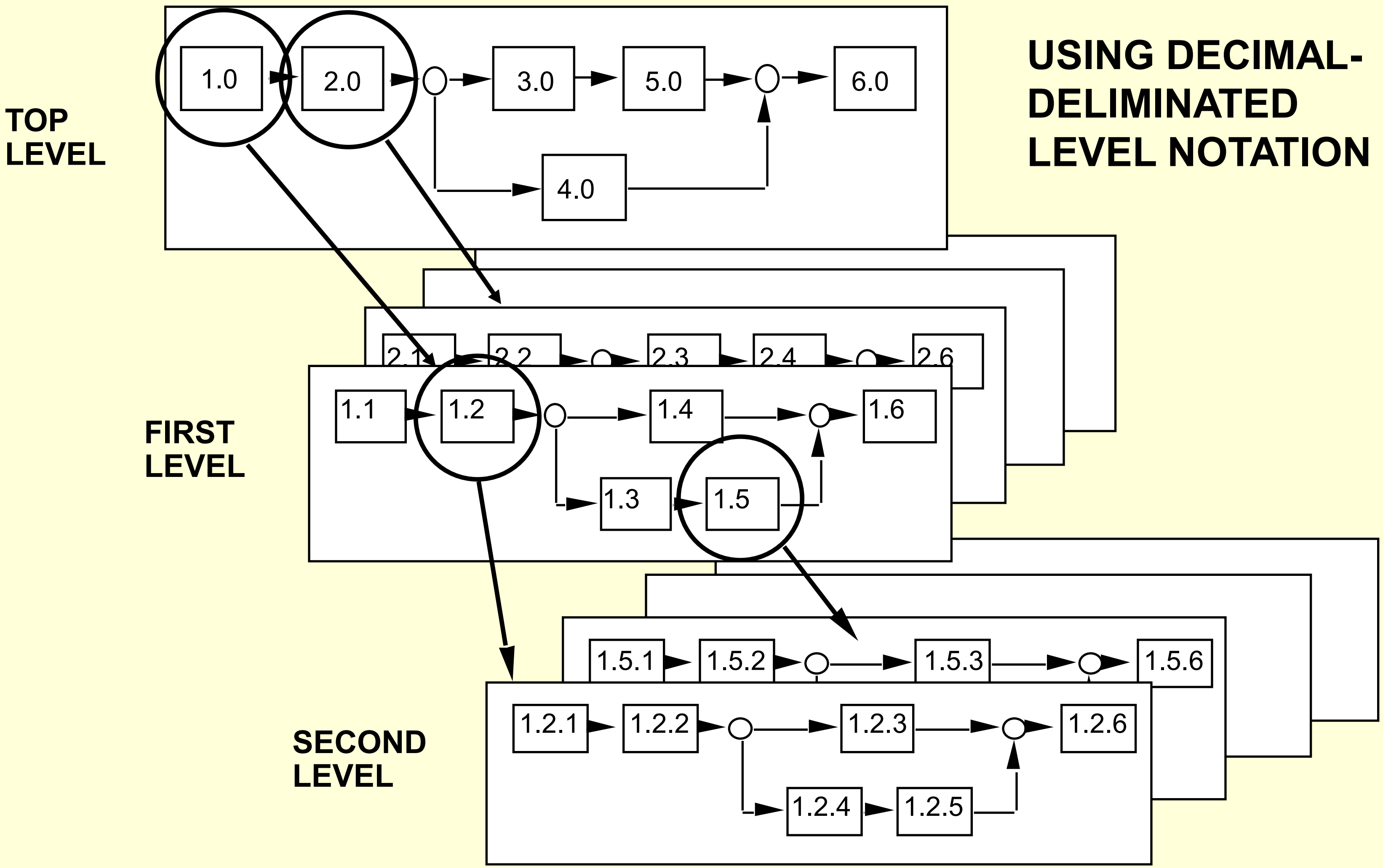
The Current System Development Paradigm



Functional Analysis and Allocation



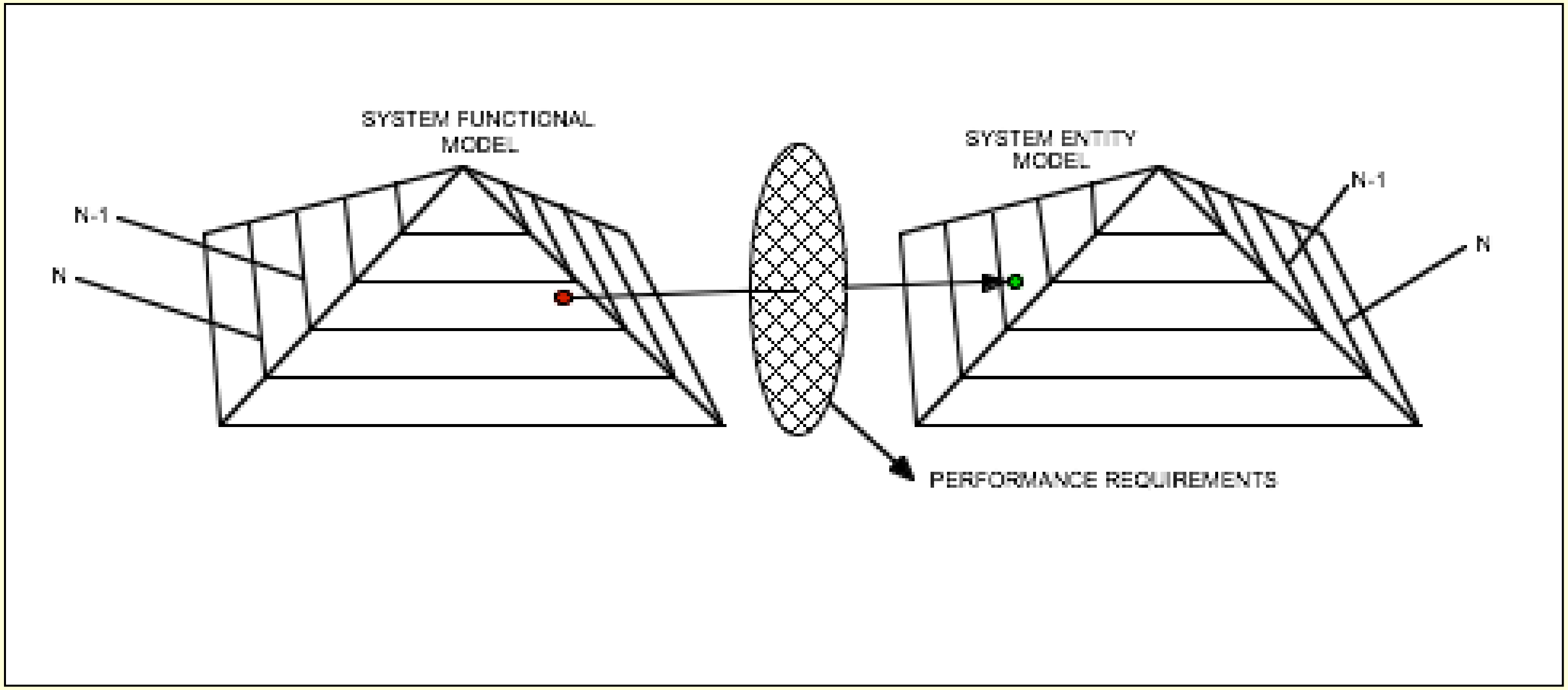
Functional Flow Diagramming Levels



Functional Allocation Pacing Alternatives

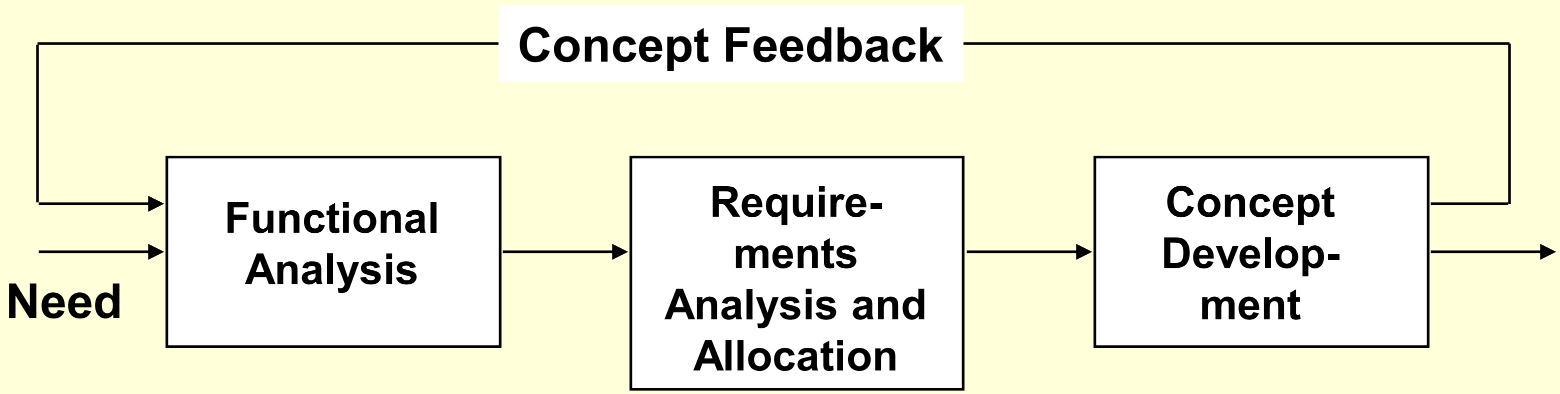
- **Serial performance**
  - Functional analysis until complete then allocate and conceptualize
- **Instant allocation**
  - See function, allocate function
- **Layered allocation**
  - FRAT concept
- **Progressive allocation**

FRAT Layered Perspective



From the work of Bernard Morias and Brian Mar.

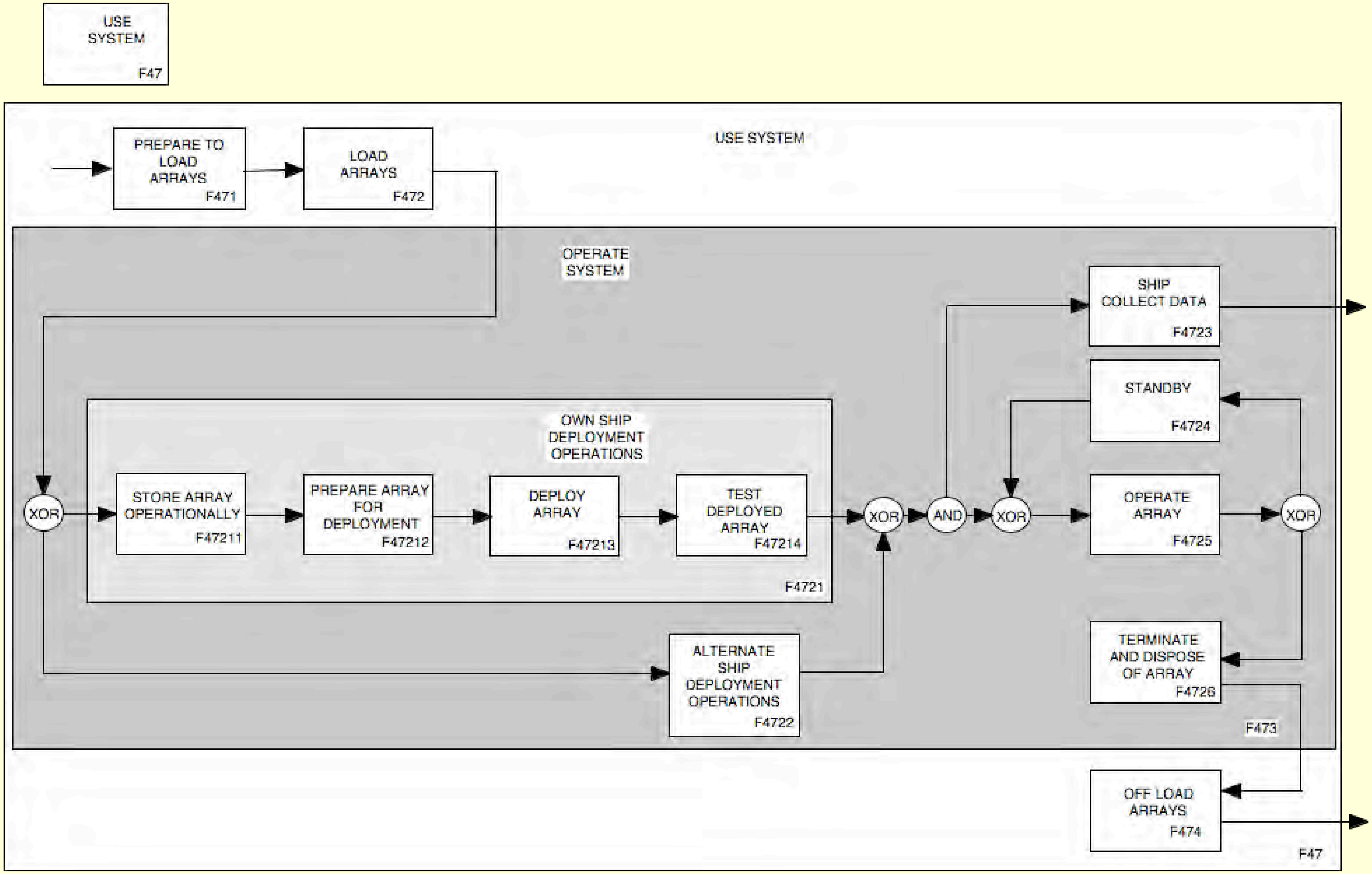
Progressive Tuning of the Functional Analysis



Lower level functional analysis guided by higher level concept definition

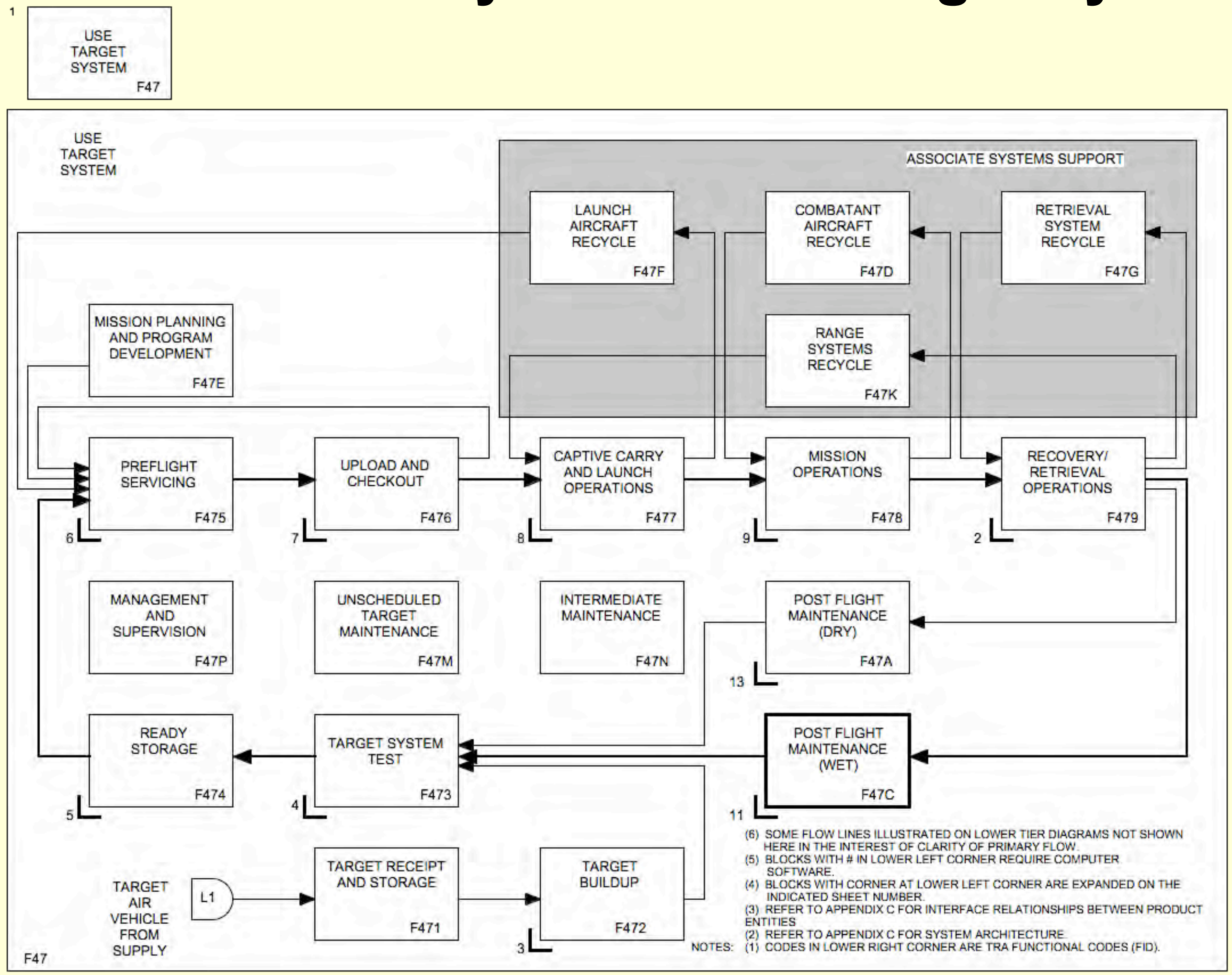
Results in tuning the action oriented functional flow diagram to a physical process diagram adequate for detailed logistics support analysis at lower tiers and environmental use profiling.

Use System Decomposition
Deployable Sonar Array



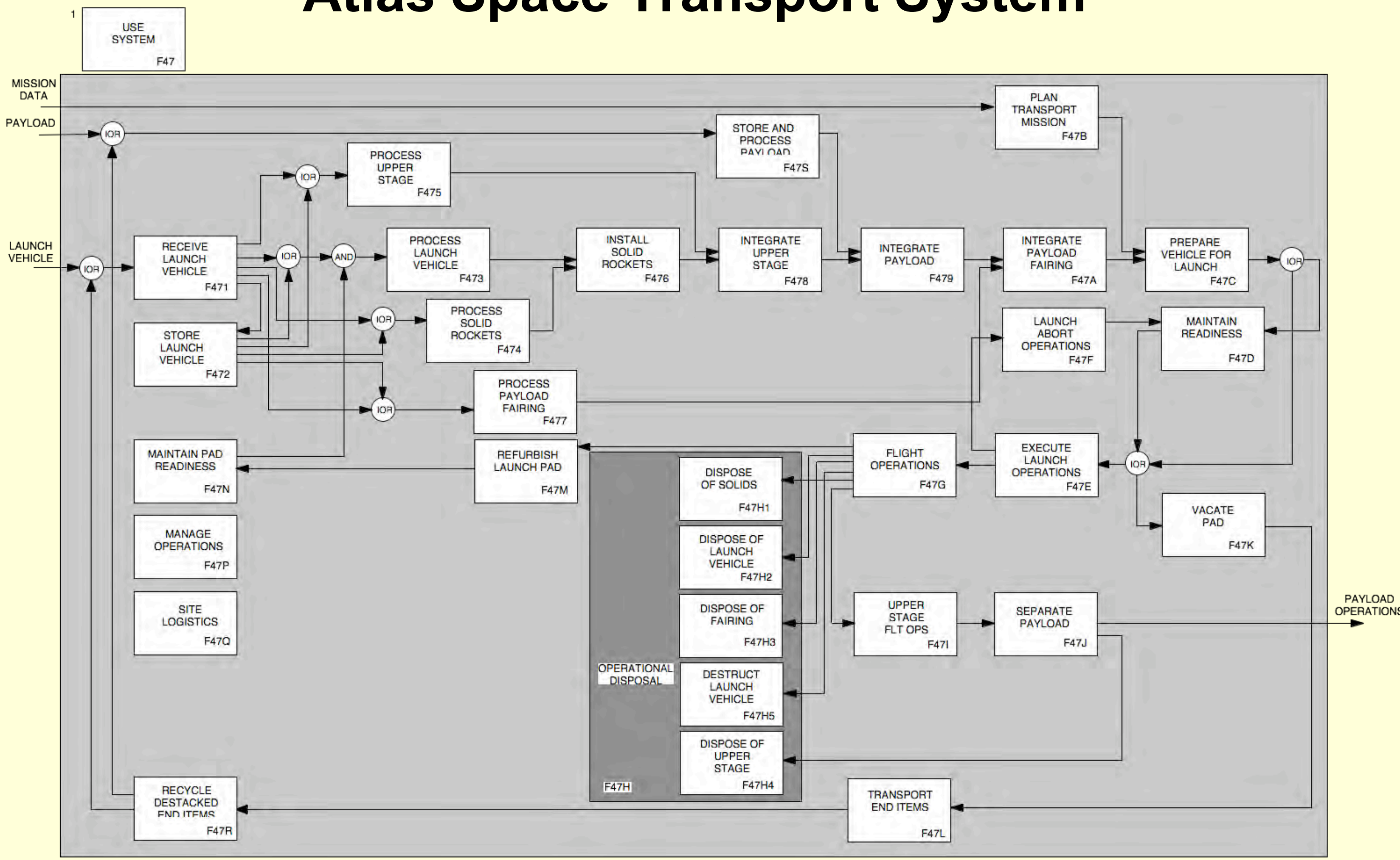
Use System Decomposition

AQM-81 USAF/Ryan Firebolt Target System



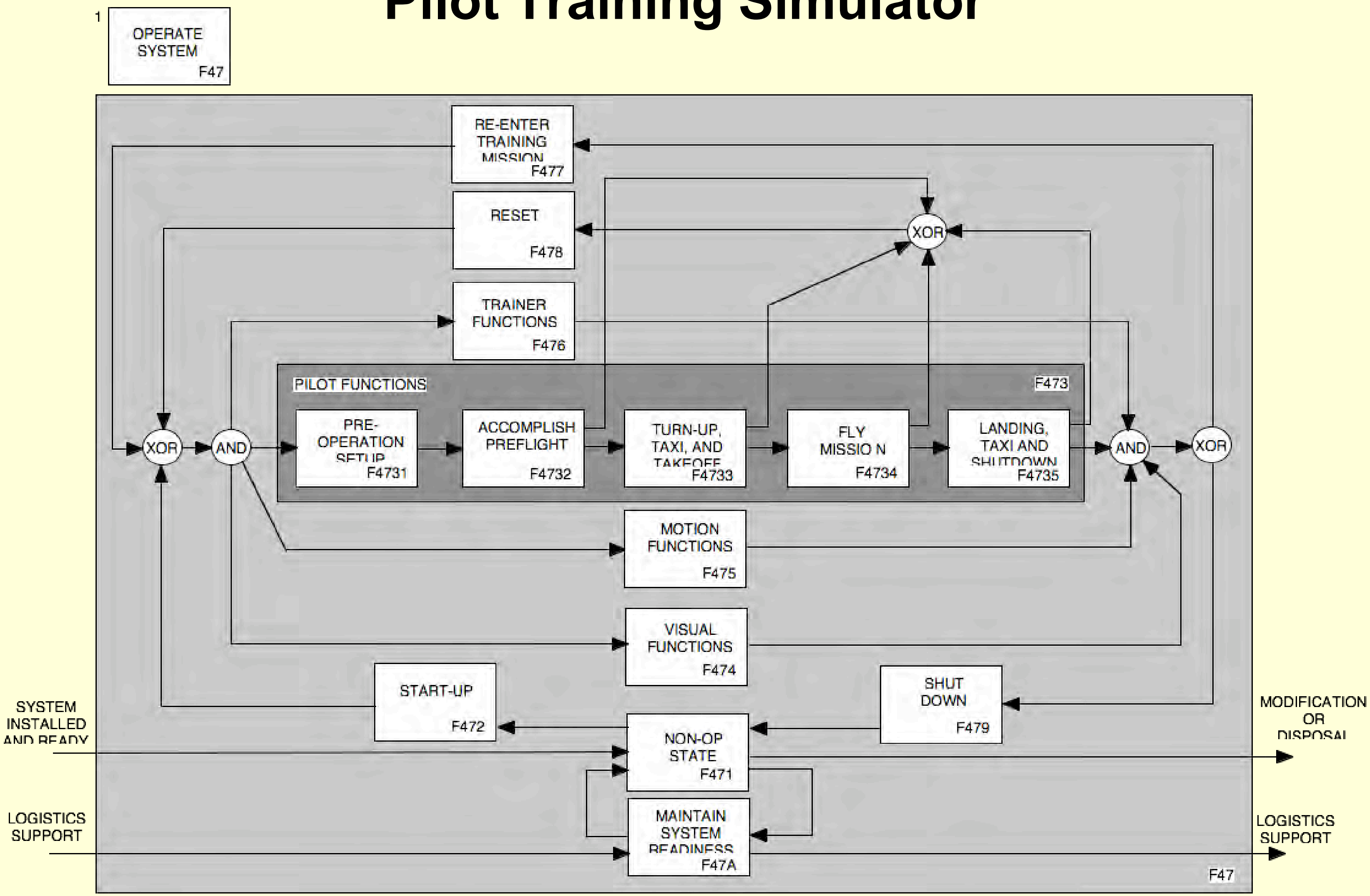
Use System Decomposition

Atlas Space Transport System

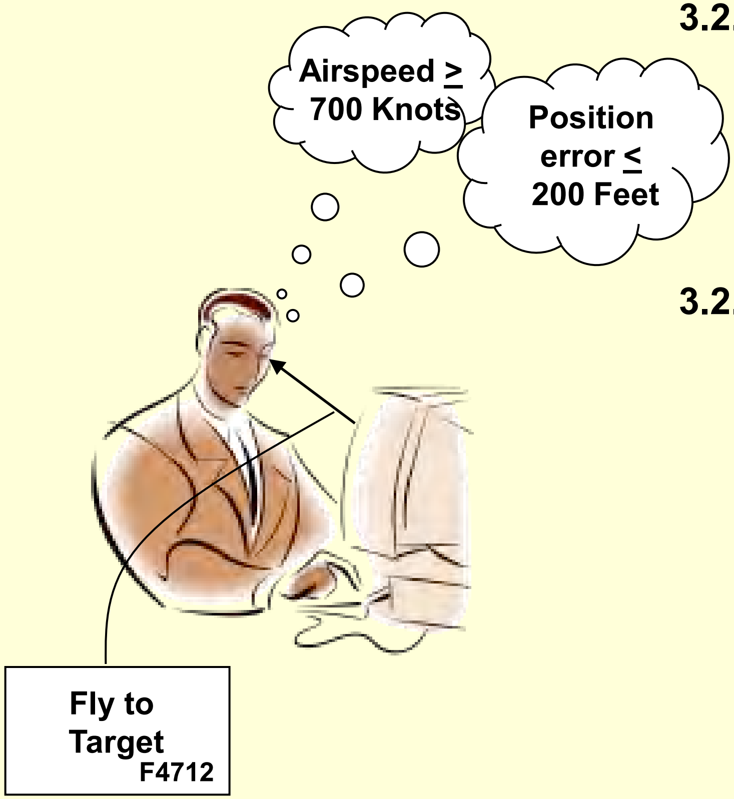


Use System Decomposition

Pilot Training Simulator



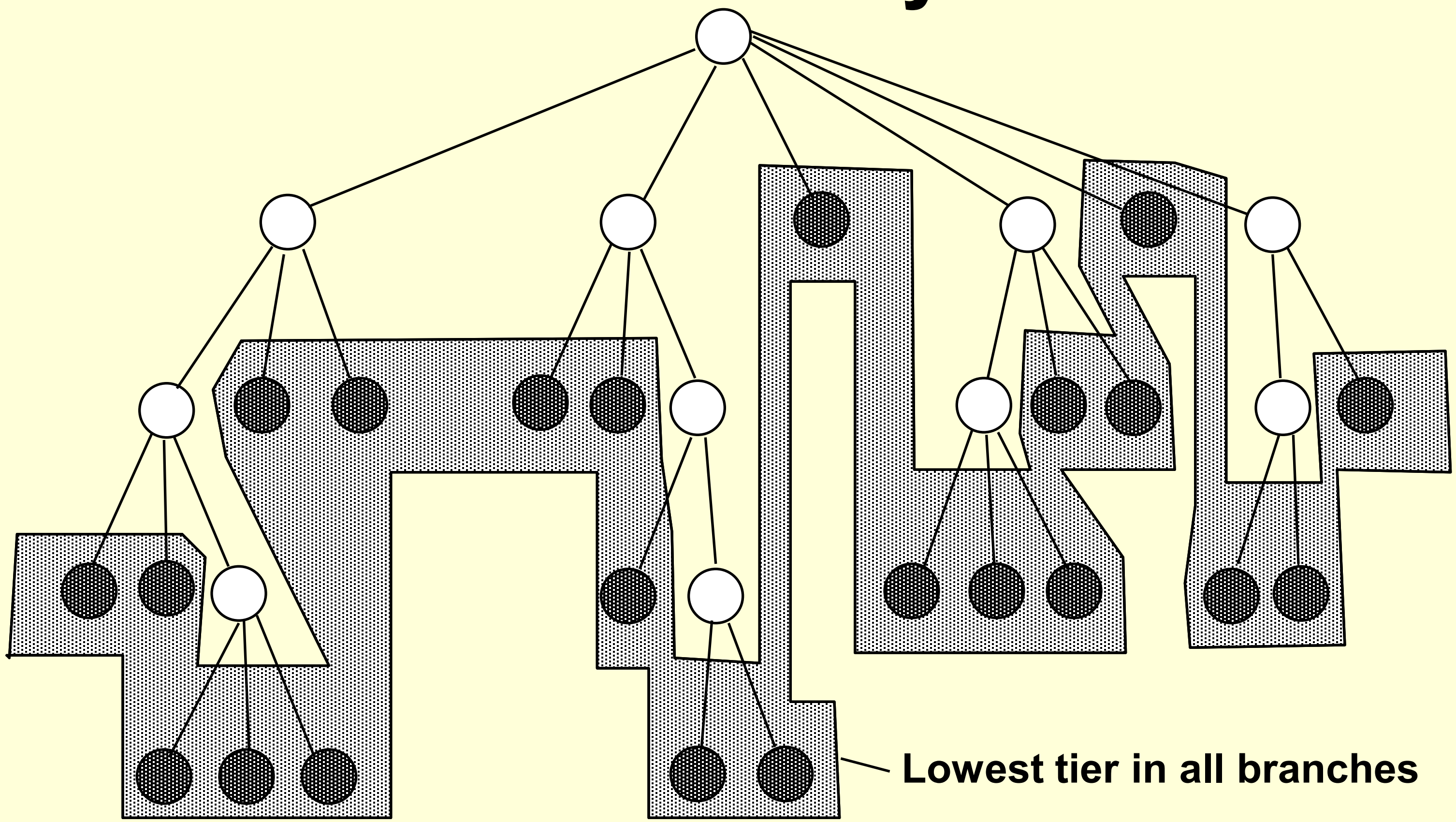
Deriving Performance Requirements



3.2.1.1 Aircraft shall be capable of flight at an airspeed $\geq$ 700 knots.

3.2.1.2 Position error at an end of leg shall be less than or equal to 200 feet in along track and cross track directions.

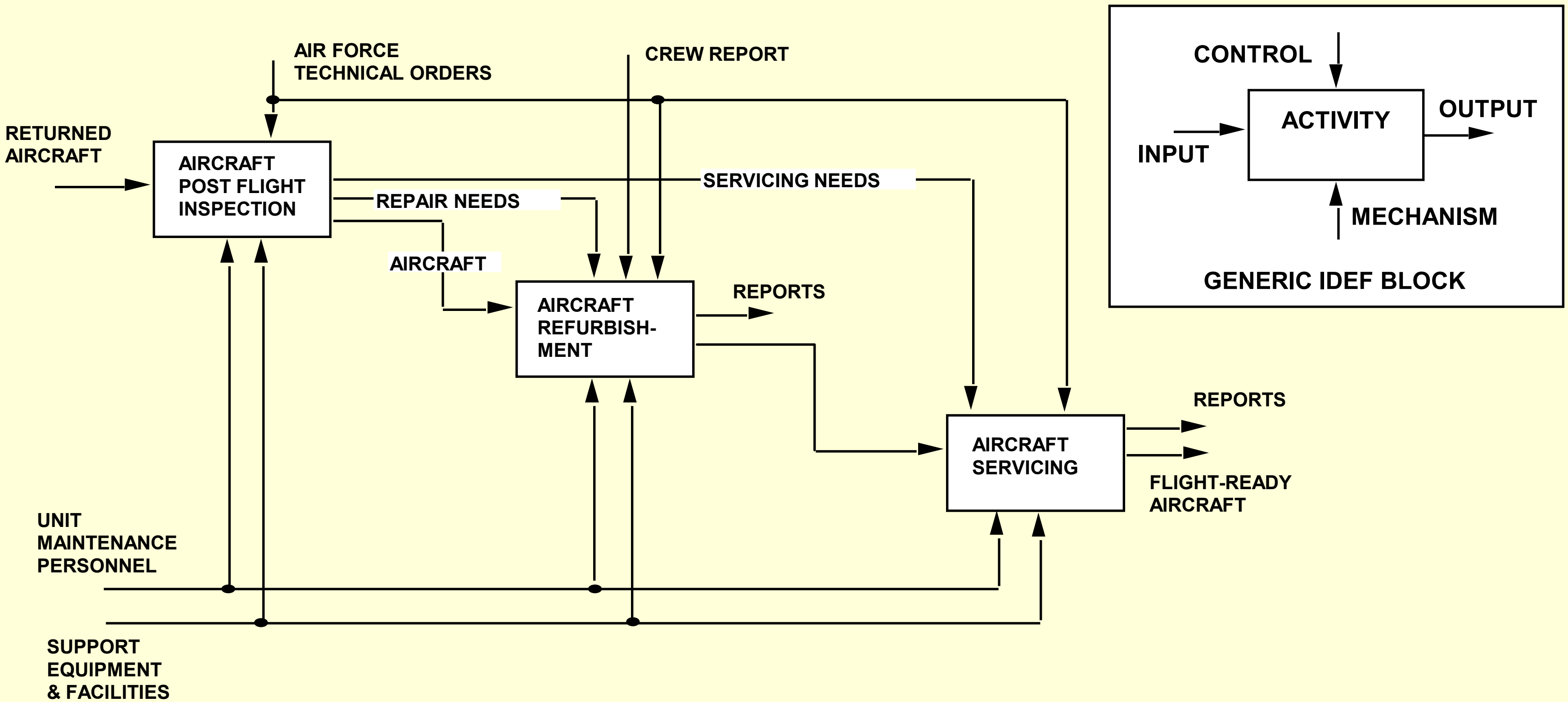
The End of Functional Decomposition In the Product Entity Structure



- Buy it at that level
- Will surrender to design by one of your design teams

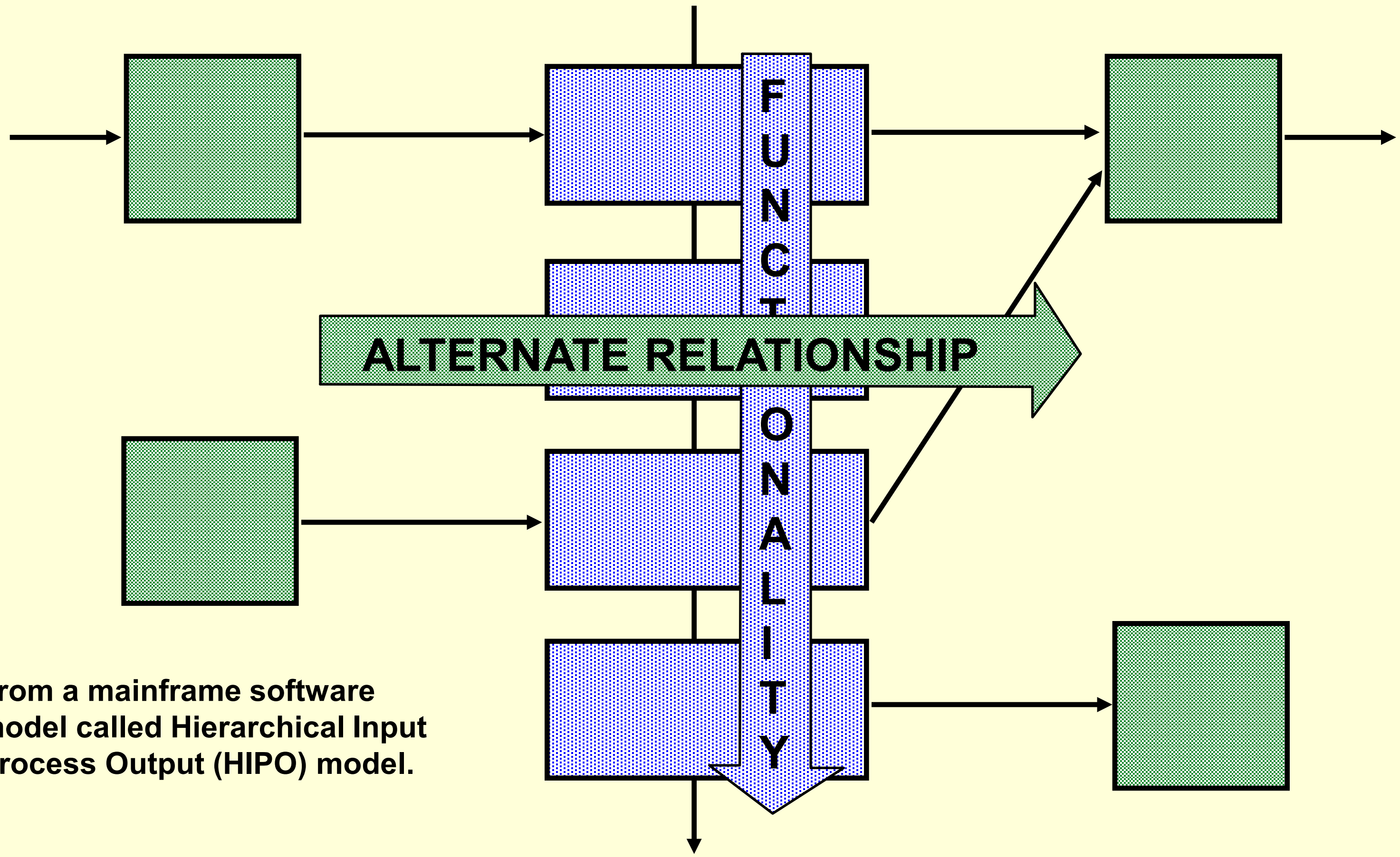
Alternative Functional Models

IDEF-Ø Diagram



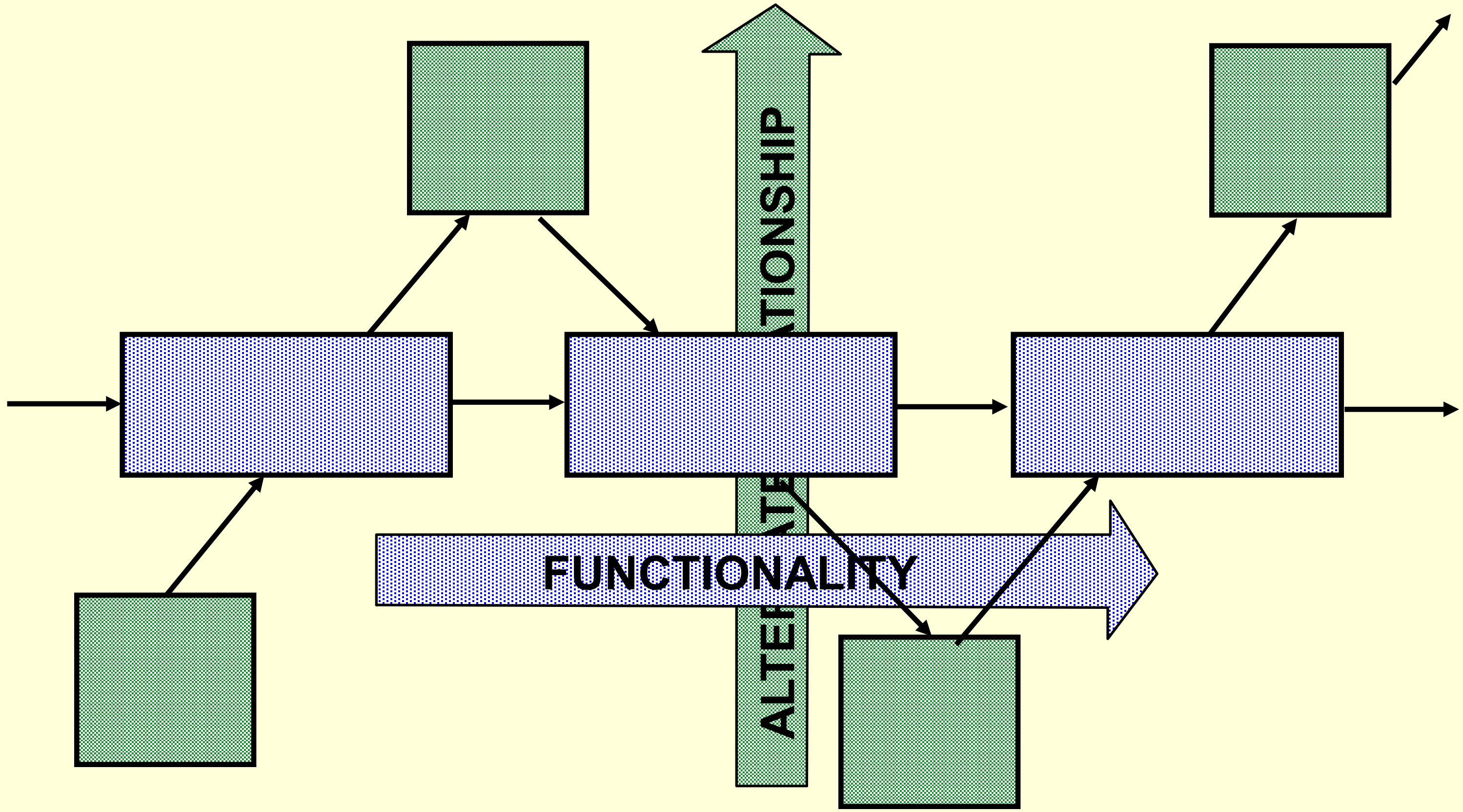
Alternative Functional Models

Behavioral Diagramming From RDD-100



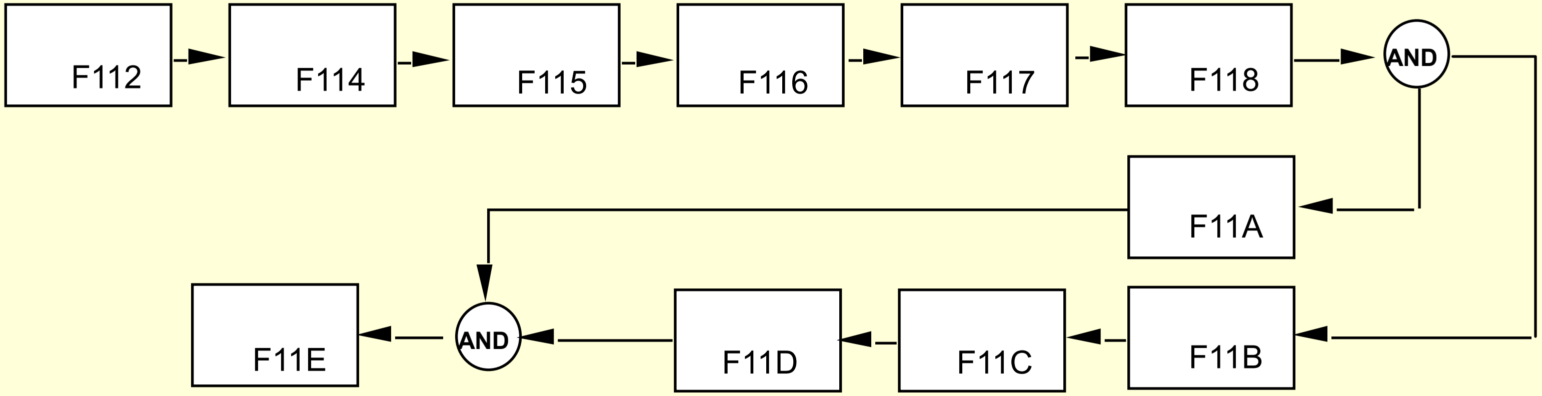
From a mainframe software model called Hierarchical Input Process Output (HIPO) model.

Alternative Functional Models
Enhanced Functional Flow Block Diagramming

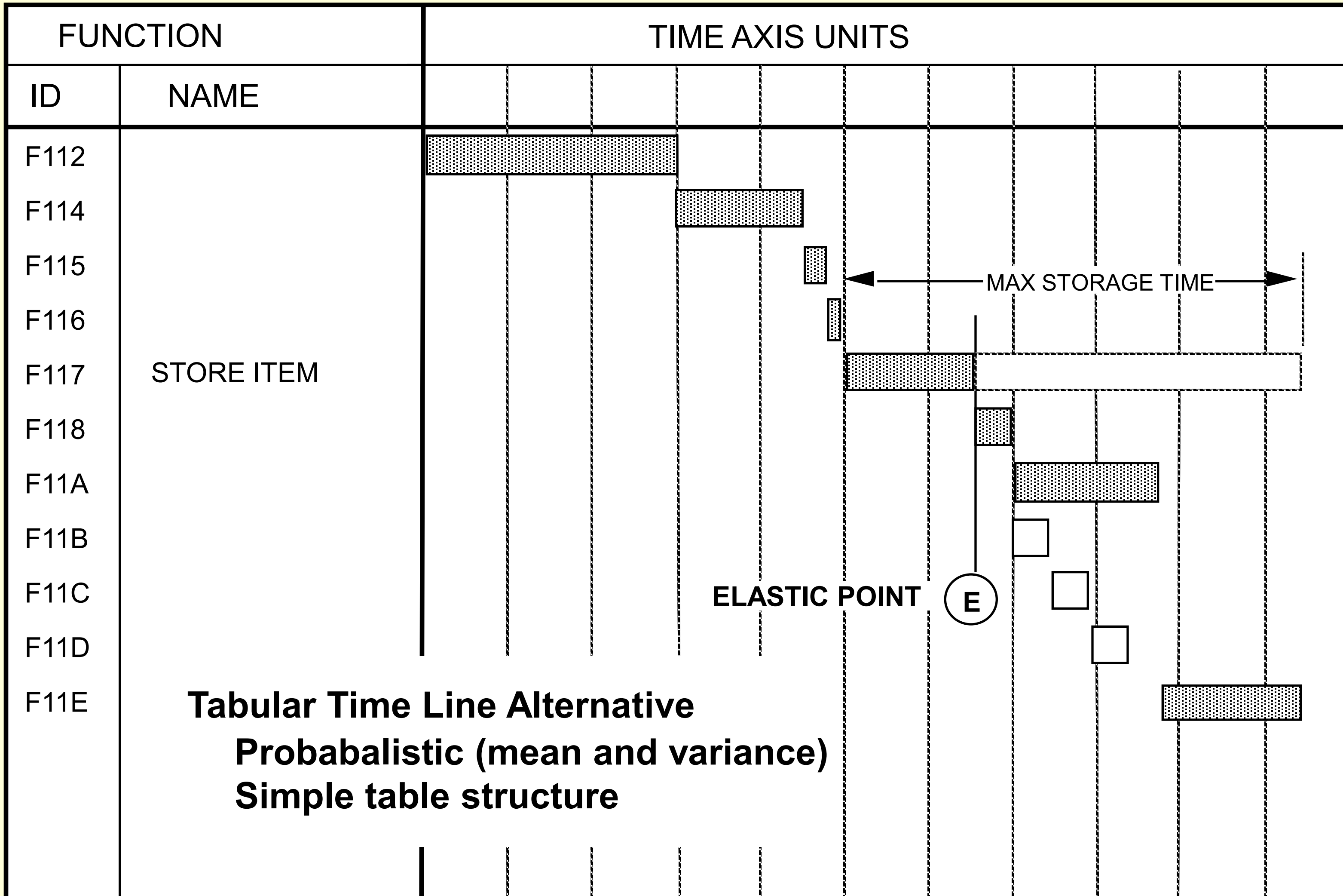


Timeline Diagramming

Assume for the moment that we have this functional flow diagram. How might we depict the timing requirements for these functions?



Timeline Diagramming

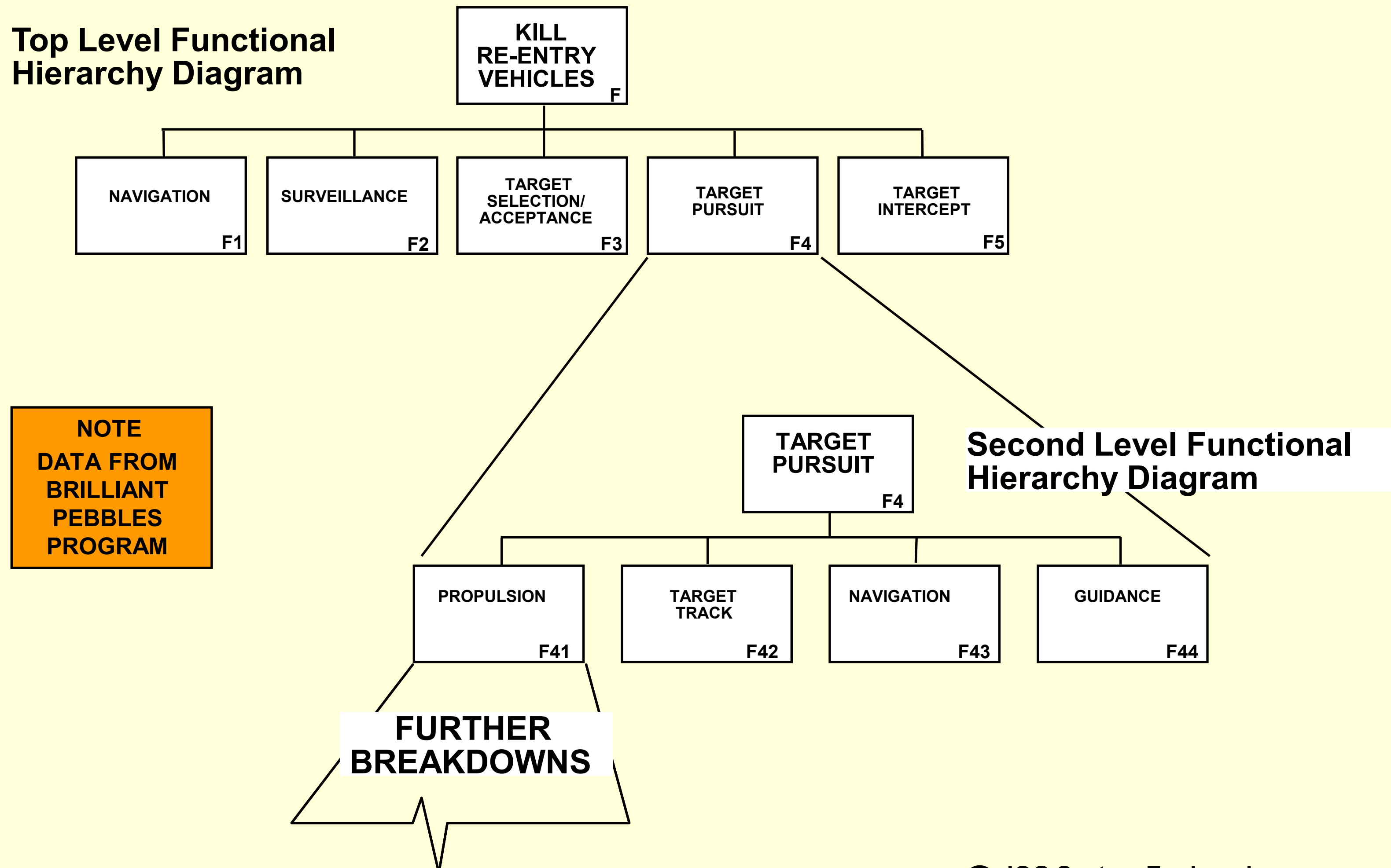


Tabular Time Line Alternative

Probabalistic (mean and variance)

Simple table structure

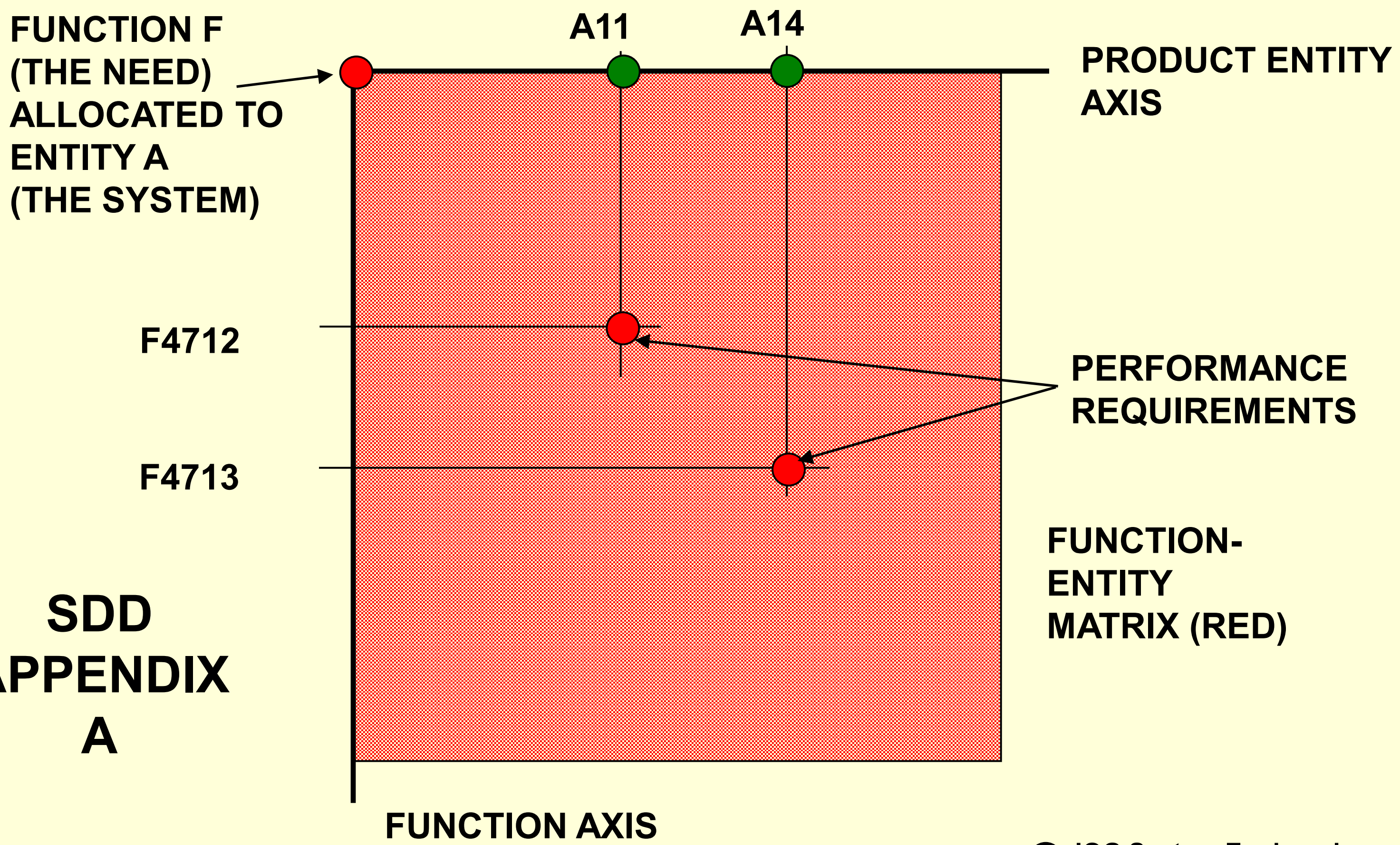
Alternative Functional Models
Hierarchical Functional Analysis



Traditional RAS

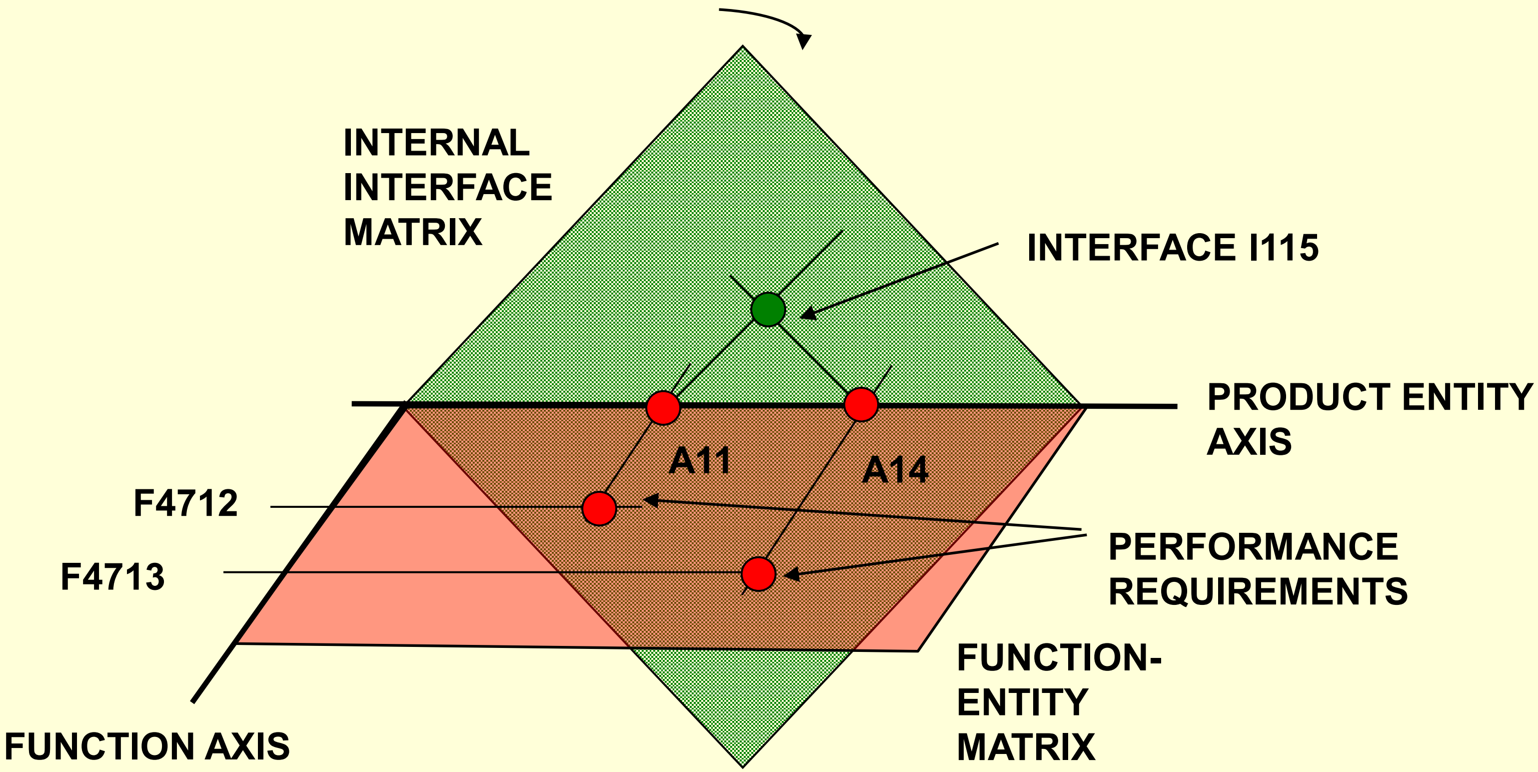
FUNCTION		PERFORMANCE REQUIREMENTS	PRODUCT ENTITY	
ID	NAME		ID	NAME
F4712 F4713 F4714 F4715	Flt to target	Airspeed $\geq$ 700 knots	A11 A14	Flight vehicle

Function-Entity Matrix (Traditional RAS)

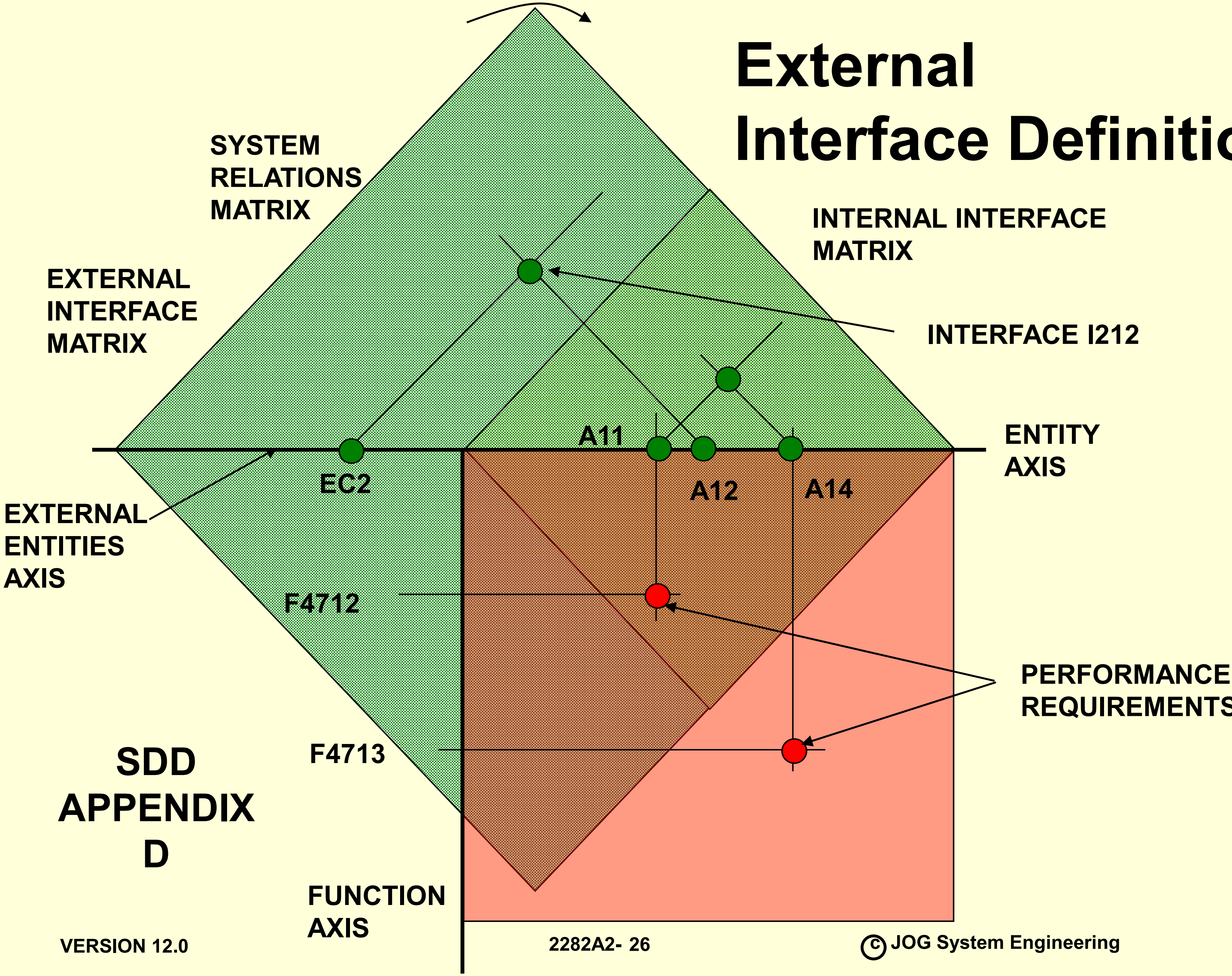


SDD APPENDIX A

RAS-Coordinated N-Square Diagram

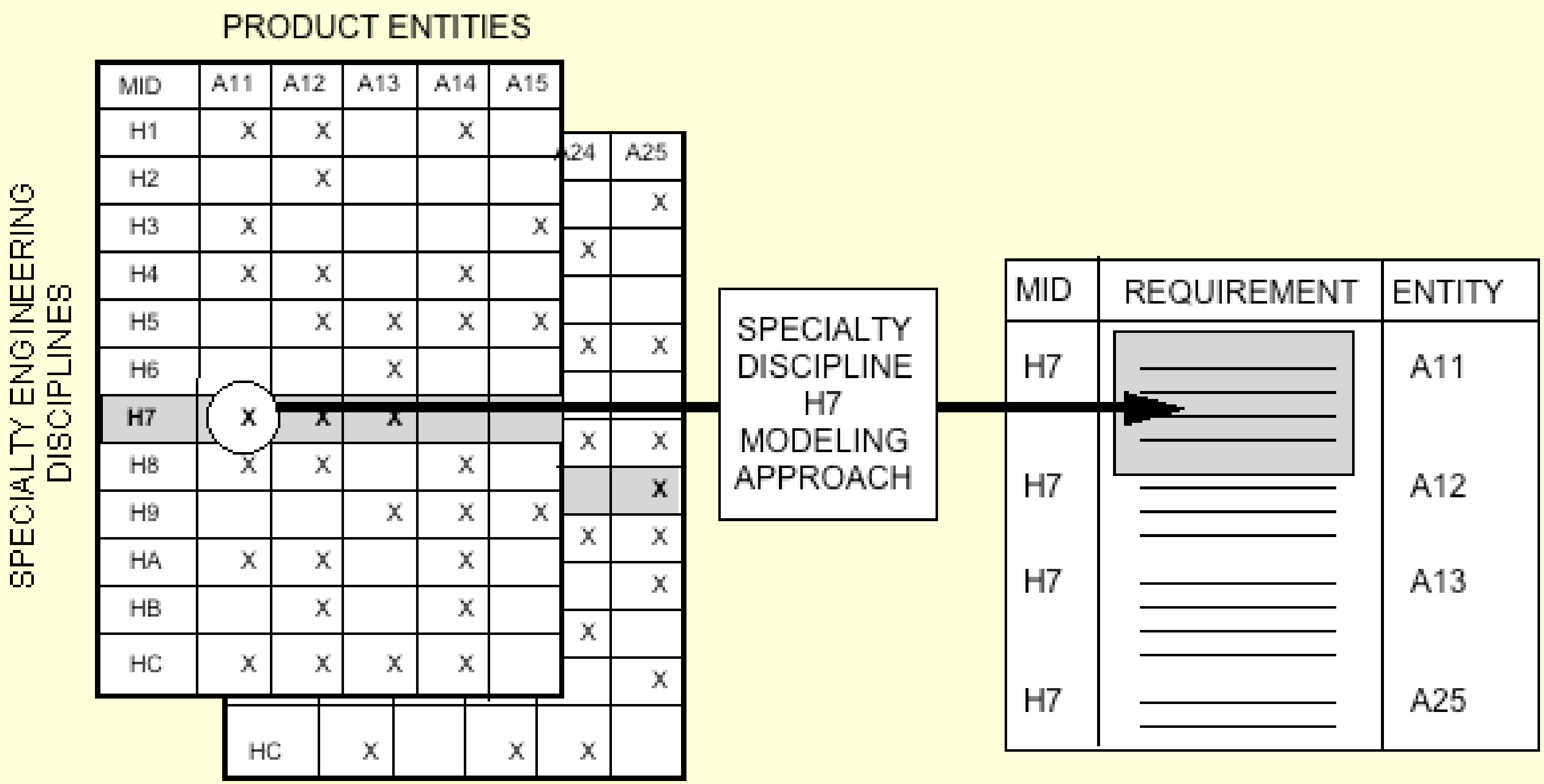


External Interface Definition



SDD APPENDIX D

Specialty Engineering Scoping Matrix

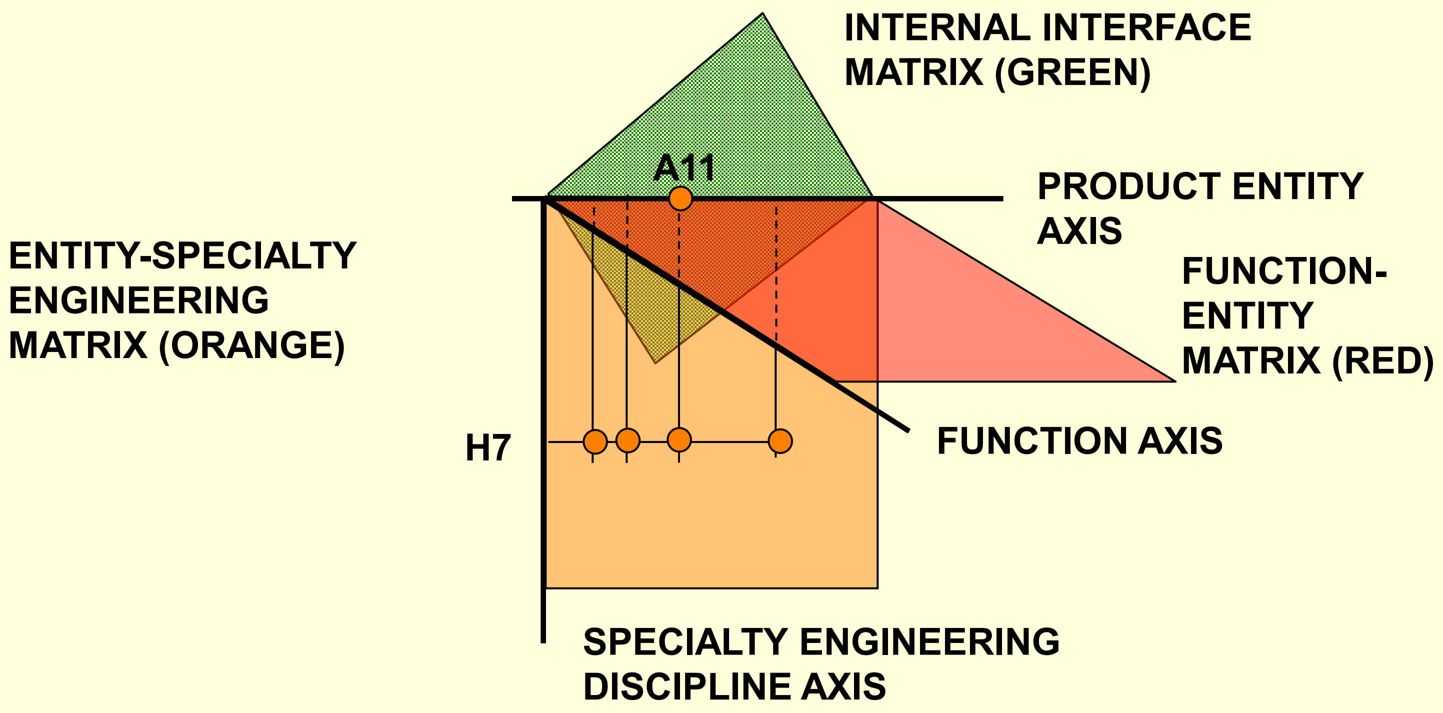


a. Specialty Engineering Scoping Matrix

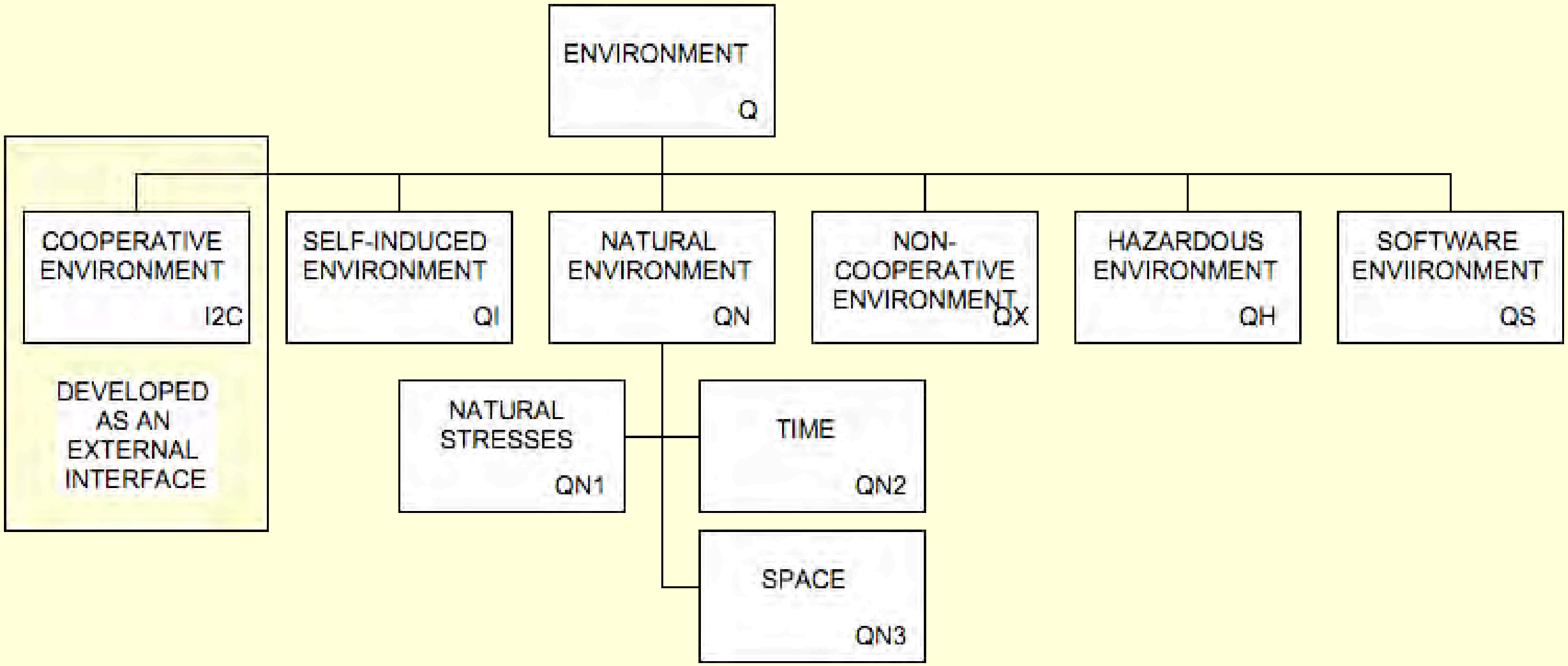
b. Requirements Analysis Sheet (RAS)

Specialty Engineering Allocation

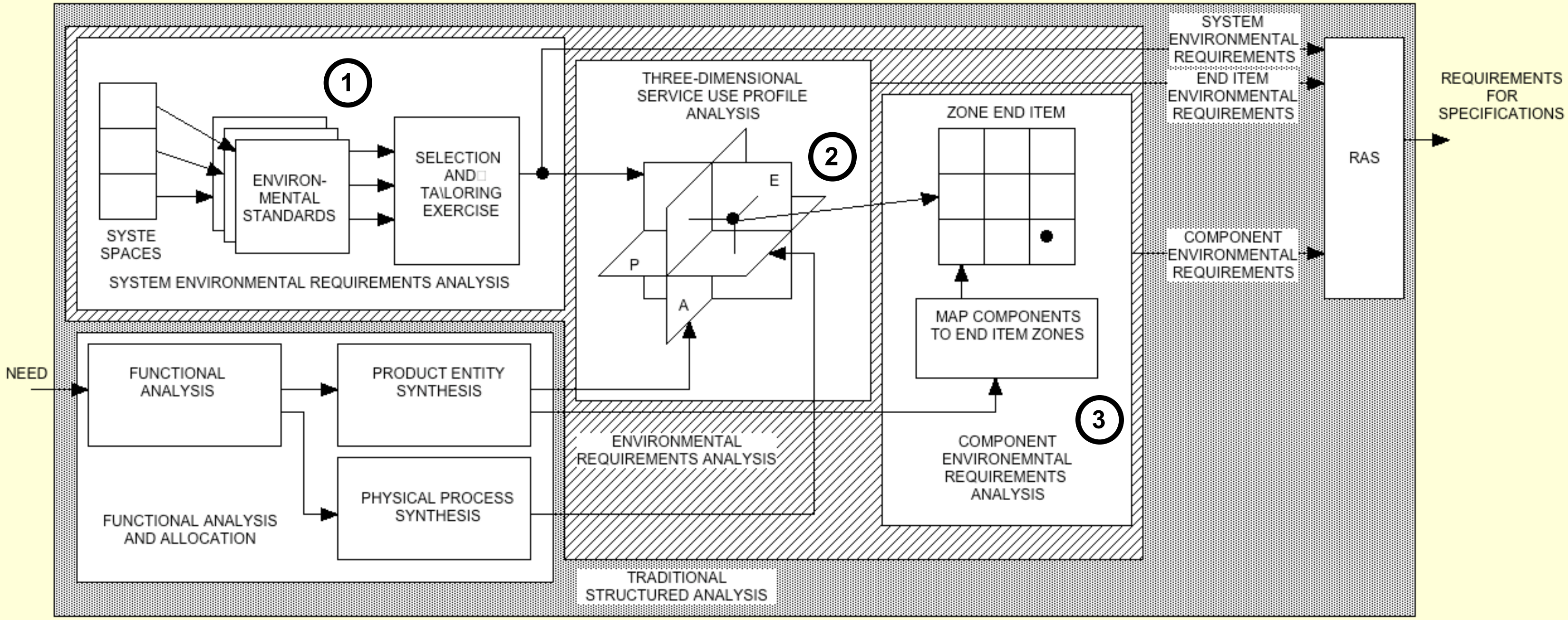
SPECIALTY DISCIPLINE H7 ALLOCATED TO ENTITY A11



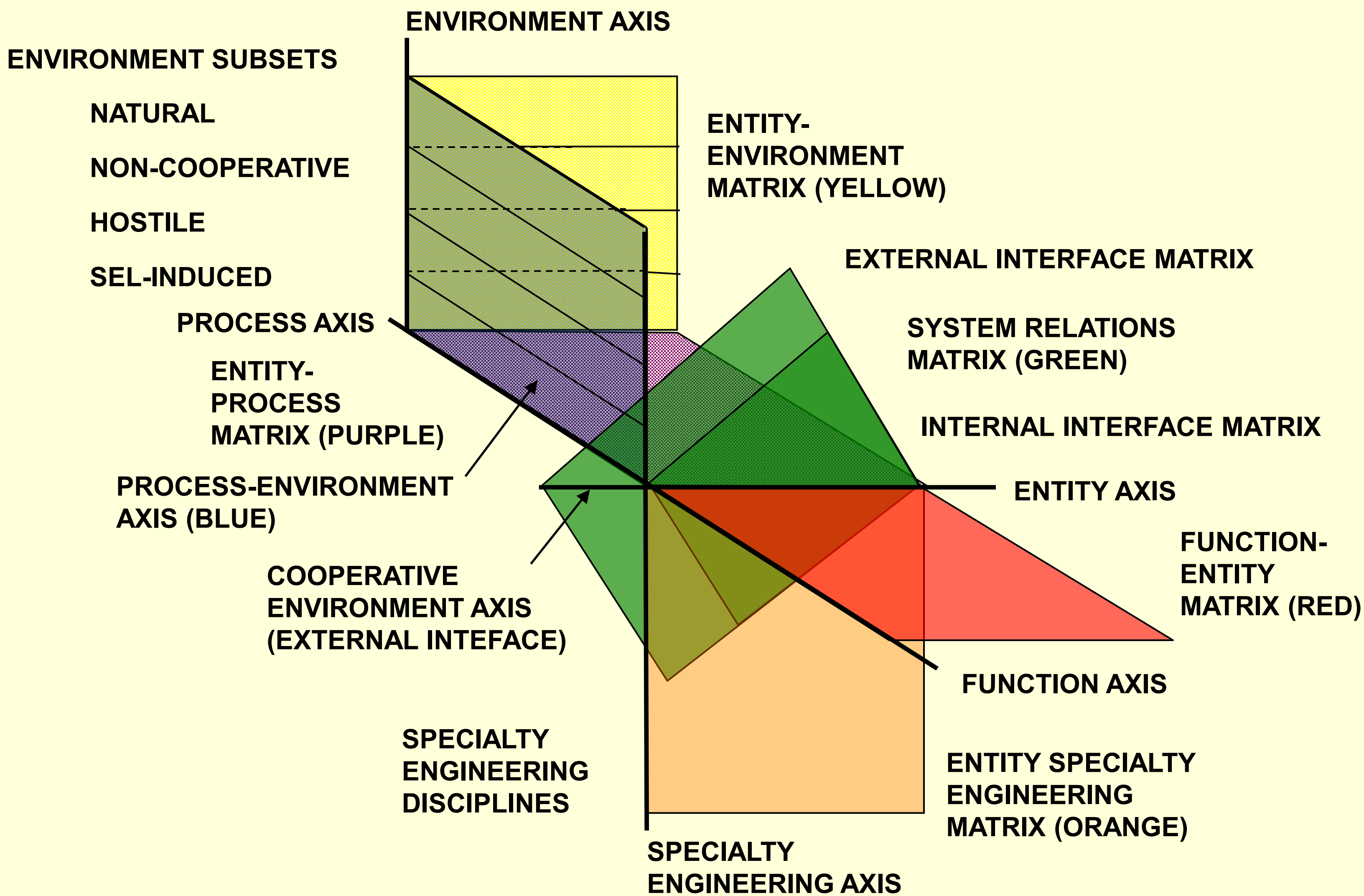
System Environmental Classes



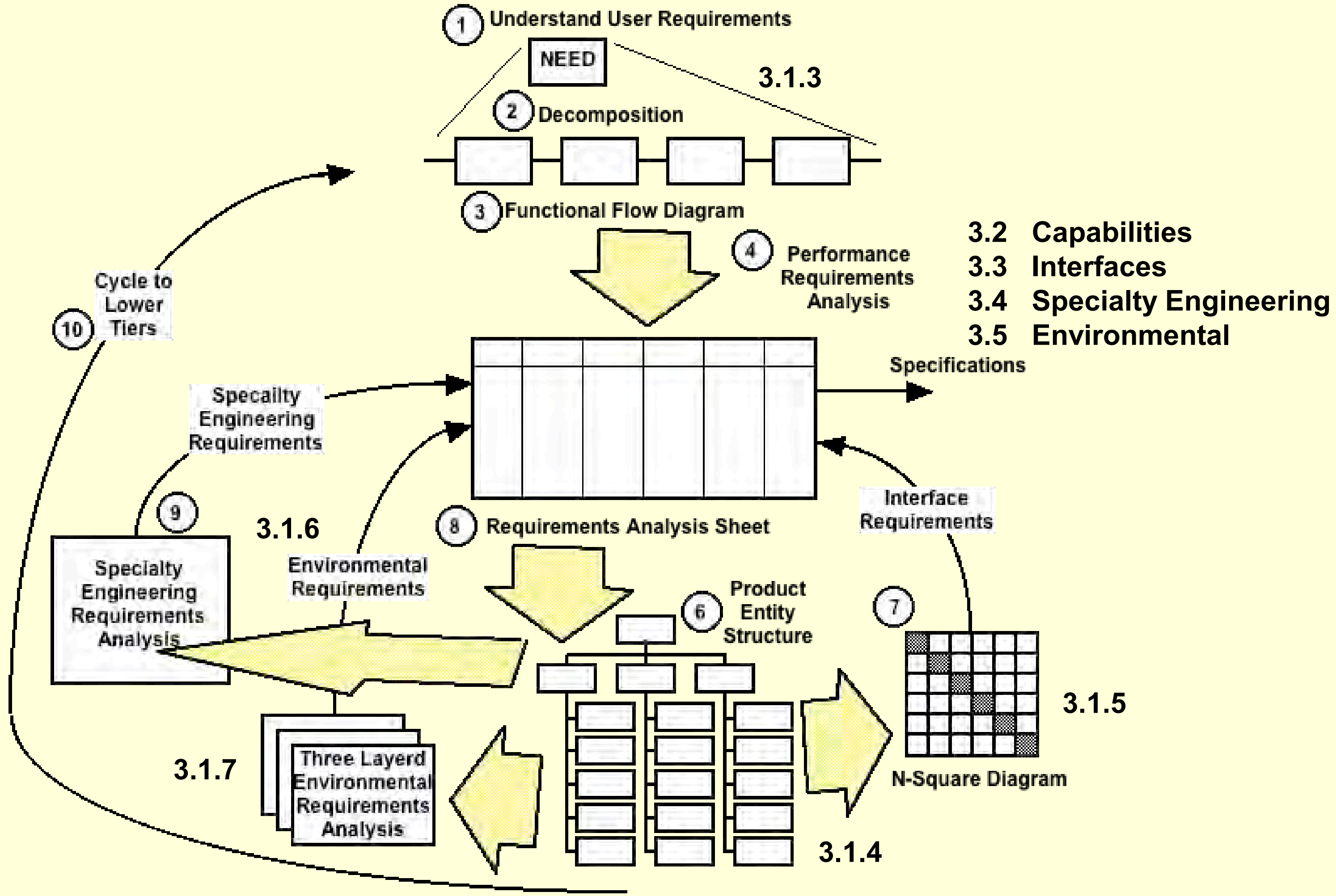
Three-Tier Environmental Requirements Construct



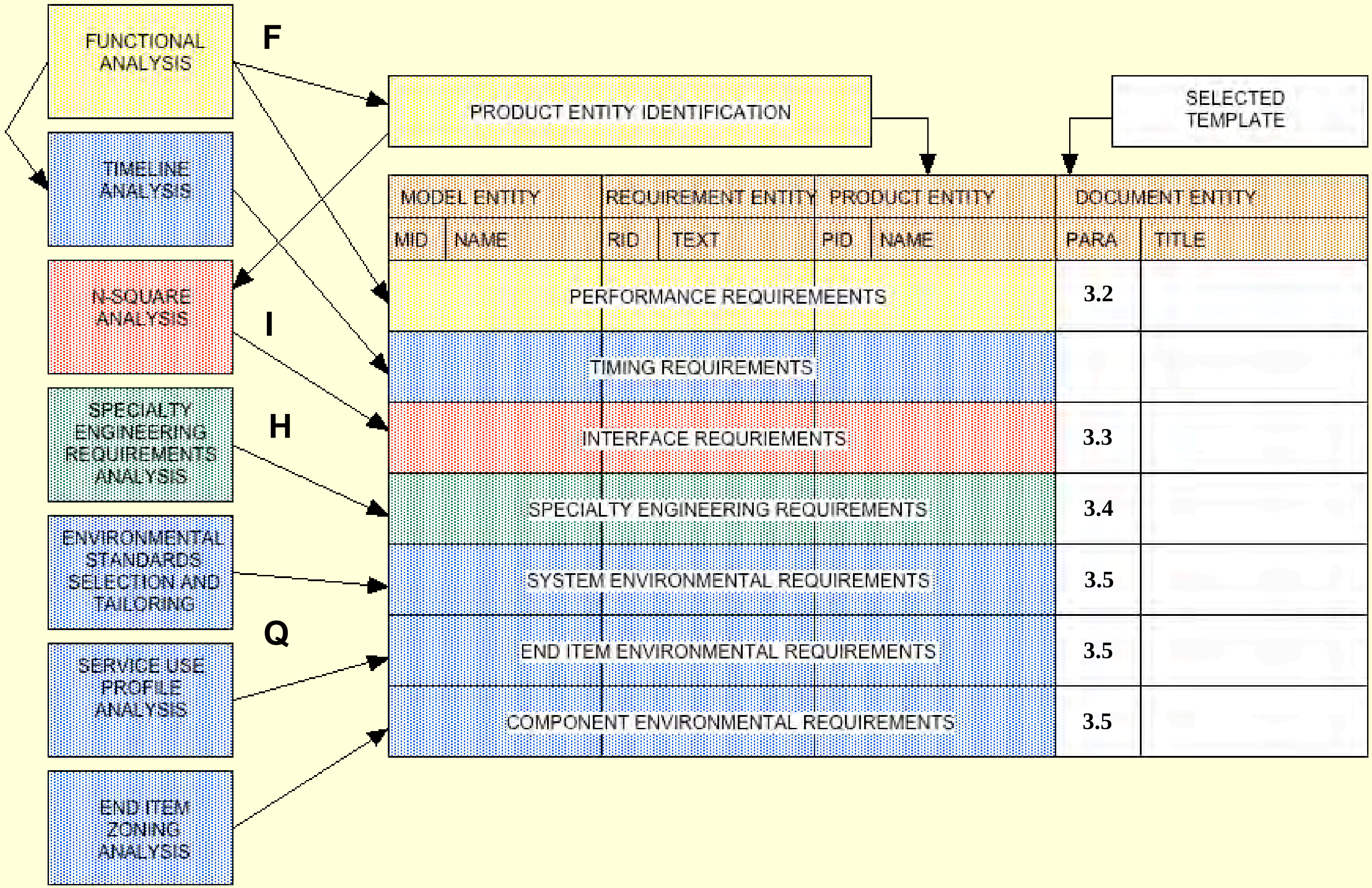
RAS Complete



Traditional Structured Analysis Overview



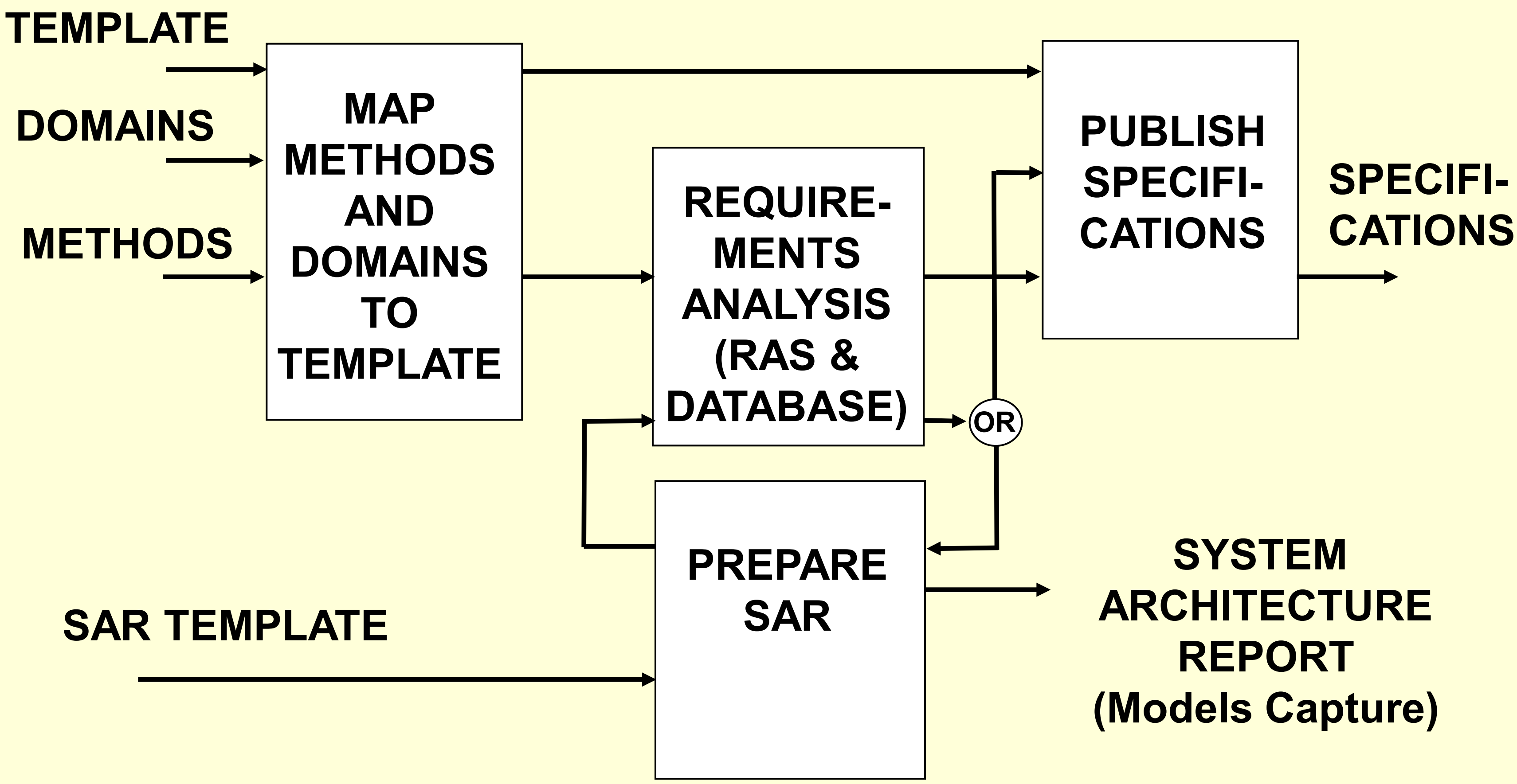
RAS-Complete, Fed From All Sources



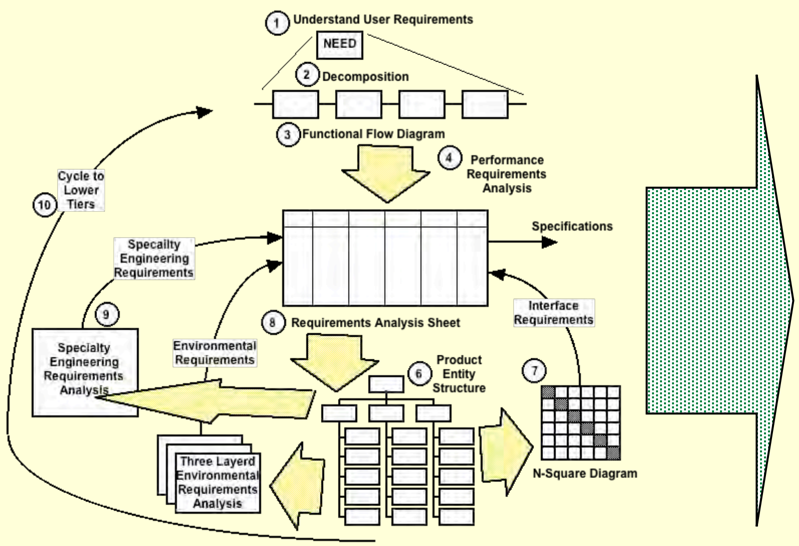
RAS-Complete In Table Form

MODEL ENTITY		REQUIREMENT ENTITY		PRODUCT ENTITY		DOCUMENT ENTITY	
MID	MODEL ENTITY NAME	RID	REQUIREMENT	PID	ITEM NAME	PARA	TITLE
F47	Use System			A	Product System		
F471	Deployment Ship Operations			A	Product System		
F4711	Store Array Operationally	XR67	Storage Volume < 10 ISO Vans	A1	Sensor Subsystem		
H	Specialty Engineering Disciplines			A	Product System		
H11	Reliability	EW34	Failure Rate < 10 x 10-6	A1	Sensor Subsystem	3.1.5	Reliability
H11	Reliability	RG31	Failure Rate < 3 x 10-6	A11	Cable	3.1.5	Reliability
H11	Reliability	FYH4	Failure Rate < 5 x 10-6	A12	Sensor Element	3.1.5	Reliability
H11	Reliability	G8R4	Failure Rate < 2 x 10-6	A13	Pressure Vessel	3.1.5	Reliability
H12	Maintainability	6GHU	Mean Time to Repair < 0.2 Hours	A1	Sensor Subsystem	3.1.6	Maintainability
H12	Maintainability	U9R4	Mean Time to Repair < 0.4 Hours	A11	Cable	3.1.6	Maintainability
H12	Maintainability	J897	Mean Time to Repair < 0.2 Hours	A12	Sensor Element	3.1.6	Maintainability
H12	Maintainability	9D7H	Mean Time to Repair < 0.1 Hours	A13	Pressure Vessel	3.1.6	Maintainability
I	System Interface			A	Product System		
I1	Internal Interface			A	Product System		
I11	Sensor Subsystem Innerface			A1			
I181	Aggregate Signal Feed Source Impedance	E37H	Aggregate Signal Feed Source Impedance= 52 ohms + 2 ohms	A1	Sensor Subsystem		
I181	Aggregate Signal Feed Load Impedance	E37I	Aggregate Signal Feed Load Impedance= 52 ohms ± 2 ohms	A4	Analysis and Reporting Subsystem		
I2	System External Interface			A	Product System		
Q	System Environment			A	Product System		
QH	Hostile Environment			A	Product System		
QI	Self-Induced Environmental Stresses			A	Product System		
QN	Natural Environment			A	Product System		
QN1	Temperature	6D74	-40 degrees F< Temperature < +140 degrees F	A	Product System		
QX	Non-Cooperative Environmental Stresses			A	Product System		

Specification Generator and Modeling Work Product Capture

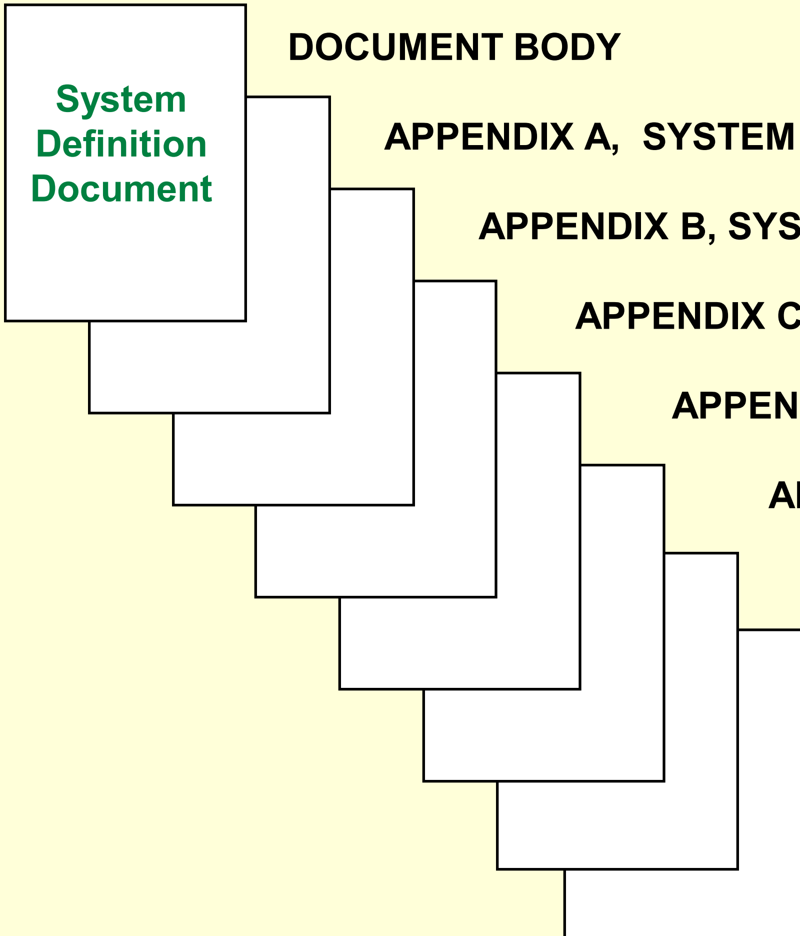


Derive Requirements From the TSA Model



3	REQUIREMENTS
3.1	Modeling
3.1.1	Need
3.1.2	User Requirements
3.1.3	Traditional Structured Modeling
3.1.4	Product Entity Modeling
3.1.5	Interface Modeling
3.1.6	Specialty Engineering Modeling
3.1.7	Environmental Classes and Modeling
3.2	Capabilities
3.3	Interface Requirements
3.4	Specialty Engineering Requirements
3.5	Environmental Requirements

SAR Organization



DOCUMENT BODY

APPENDIX A, SYSTEM FUNCTIONALITY

APPENDIX B, SYSTEM ENVINROMENT

APPENDIX C, PRODUCT ENTITY

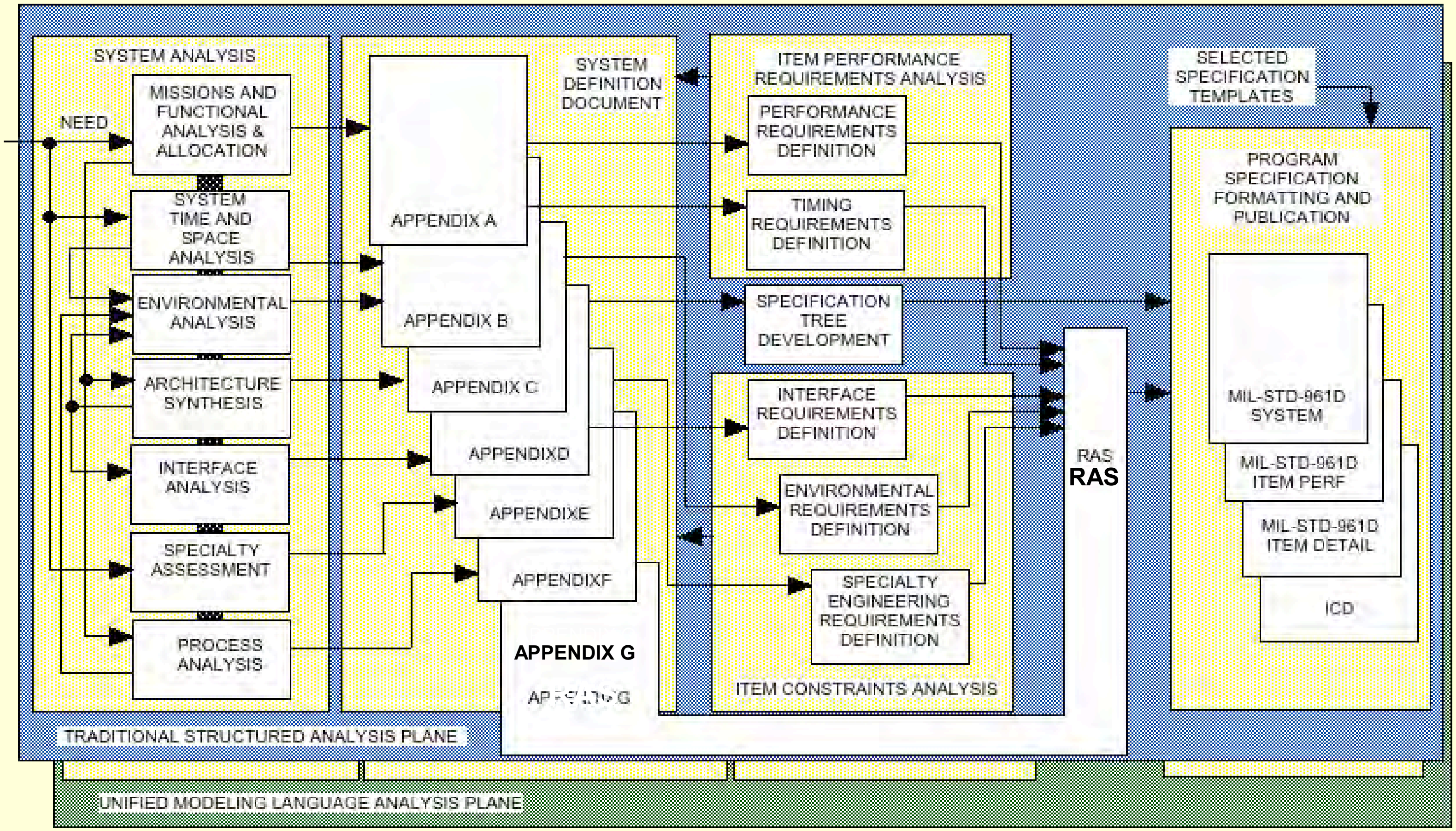
APPENDIX D, INTERFACE

APPENDIX E, SPECIALTY ENGINEERING

APPENDIX F, PROCESS

APPENDIX G, RAS

SAR Organization For Traditional Structured Analysis



Extending TSA to Software

- We will not spend a lot of time on this because most of us understand how flow charting was used in software development
- But a UADF can clearly be built reflecting how modeling was done in the 1950 and 1960s
- The blocks represented computer processing required and the directed line segments the sequence of processing.
- HIPO extended the diagram latterly to cover data flow.

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UNIVERSAL ARCHITECTURE DESCRIPTION FRAMEWORK

MSA/PSARE OVERVIEW AND UADF CONSTRUCT

Period Goals

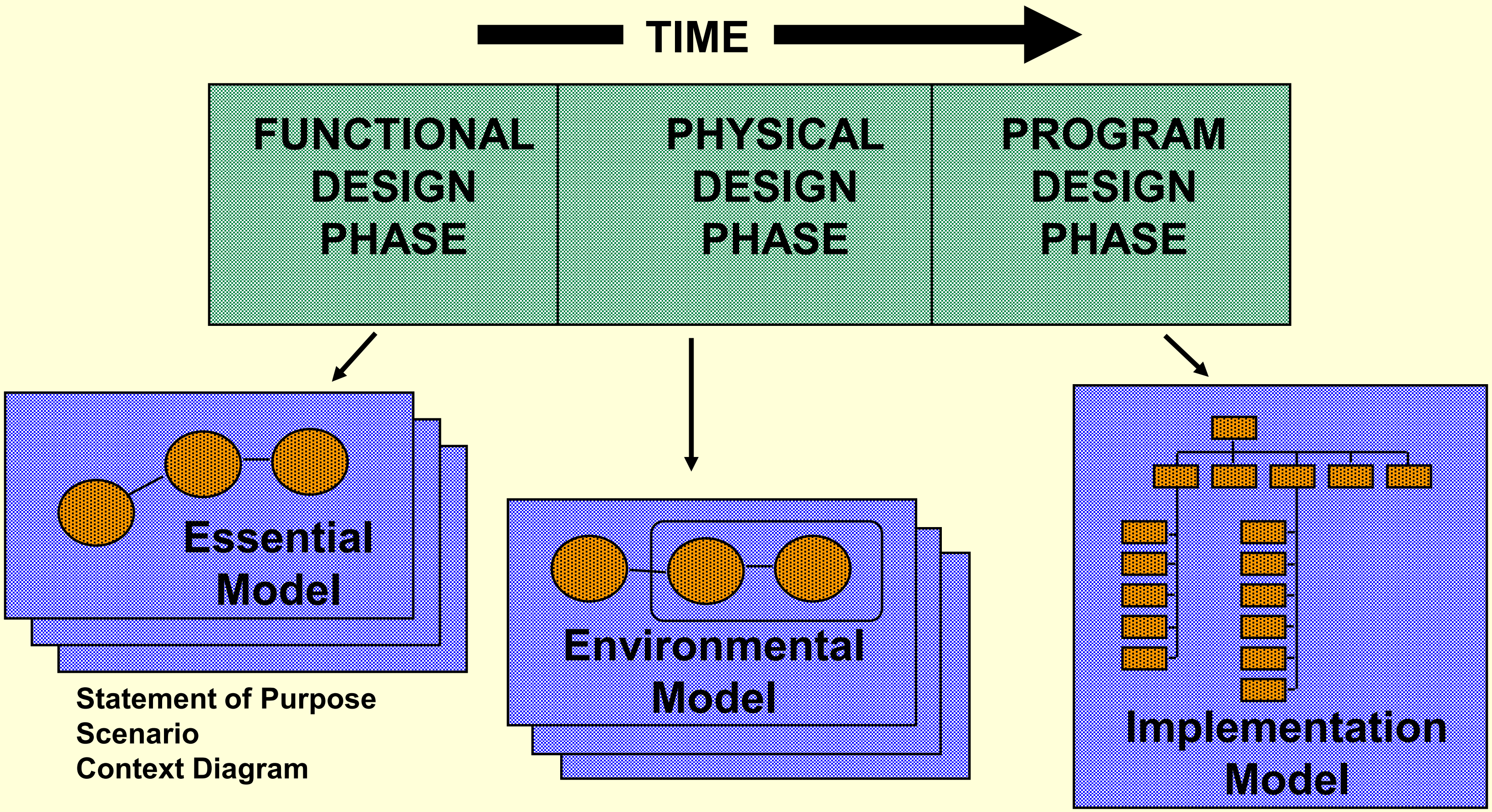
- Review the MSA approach derived from work by Yourdon, DeMarco, and others
- Extend the MSA model to the PSARE model that deals with control aspects of problem space and extends coverage to systems and hardware entities.
- Show how PSARE applies to hardware as well as software development

Computer Software Modeling Alternatives

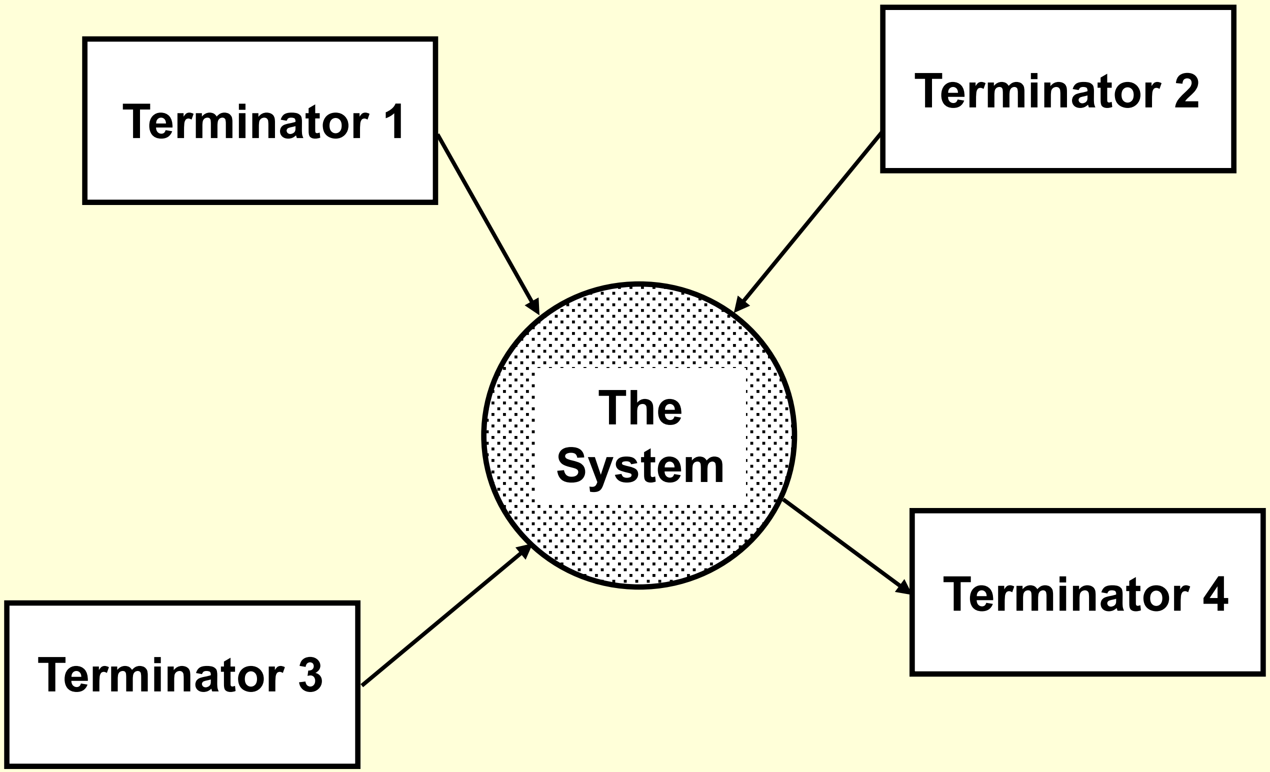
- **Process-oriented modeling**
  - Miscellaneous early methods
    - Flow charting
    - HIPO, IPO, behavioral diagrams
    - Structure diagram
  - Modern structured analysis
    - Yourdon-Demarco
    - Hatley-Pirbhai real time method now known as PSARE
- **Data oriented**
  - Table normalizing
  - IDEF-1X
  - DoDAF
- **Object oriented**
  - Early OOA
  - UML

Modern Structured Analysis

Modeling Sequence



Modern Structured Analysis
Context Diagram - The Ultimate DFD



Modern Structured Analysis

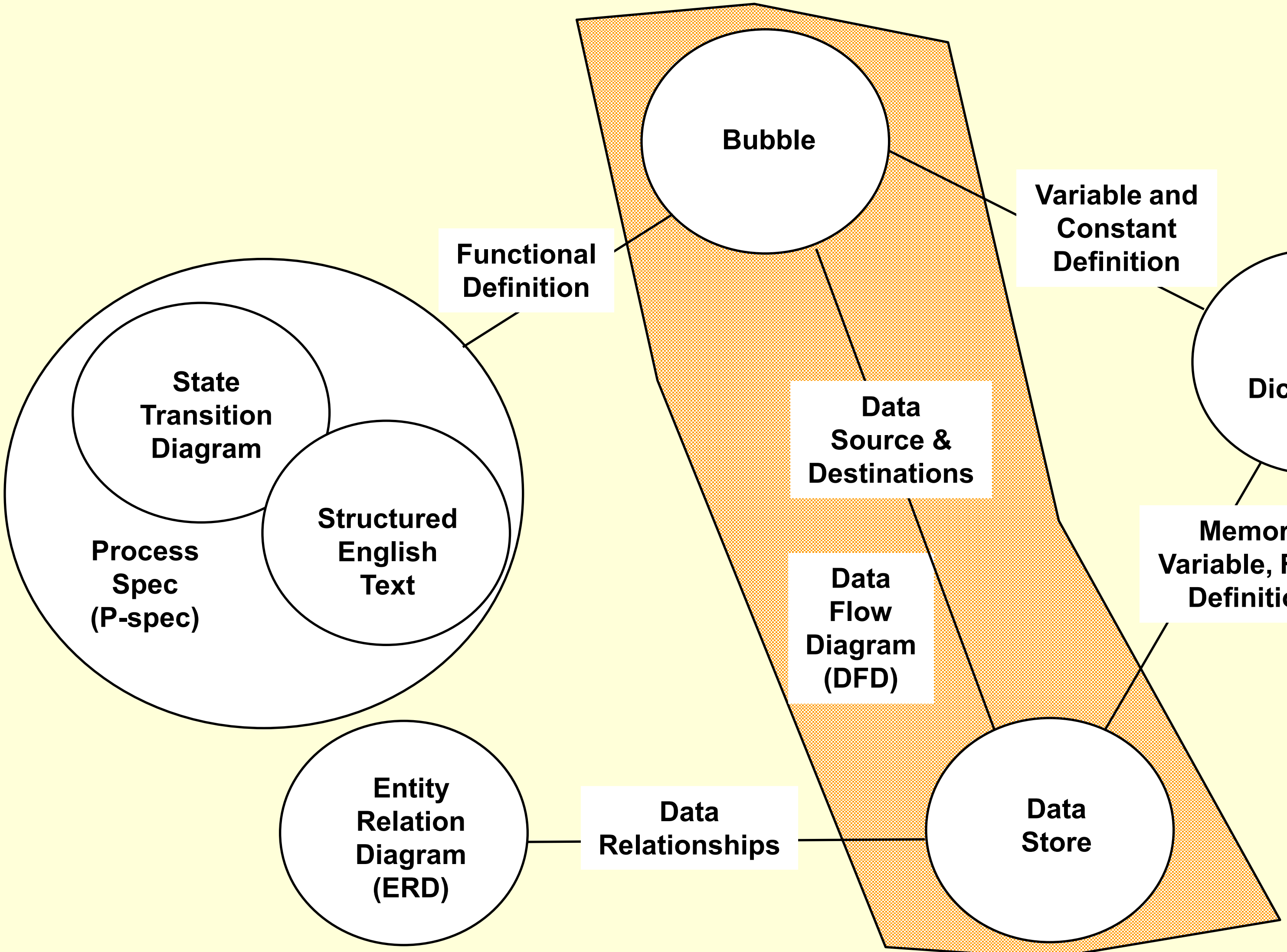
A Scenario in the Form of an Event List

Elevator System Event List	
1.	Passenger issues up summons request.
2.	Passenger issues down summons request.
3.	Elevator reaches summoned floor.
4.	Elevator not available for summons request.
5.	Elevator becomes available for summons.
6.	Passenger issues destination request.
7.	Elevator reaches requested destination.
8.	Elevator arrives at floor.
9.	Elevator departs floor.
10.	Elevator fails to move (goes out of service).
11.	Elevator returns to normal service.
12.	Elevator becomes overloaded.
13.	Elevator load becomes normal.

Phrase events from perspective of the environment

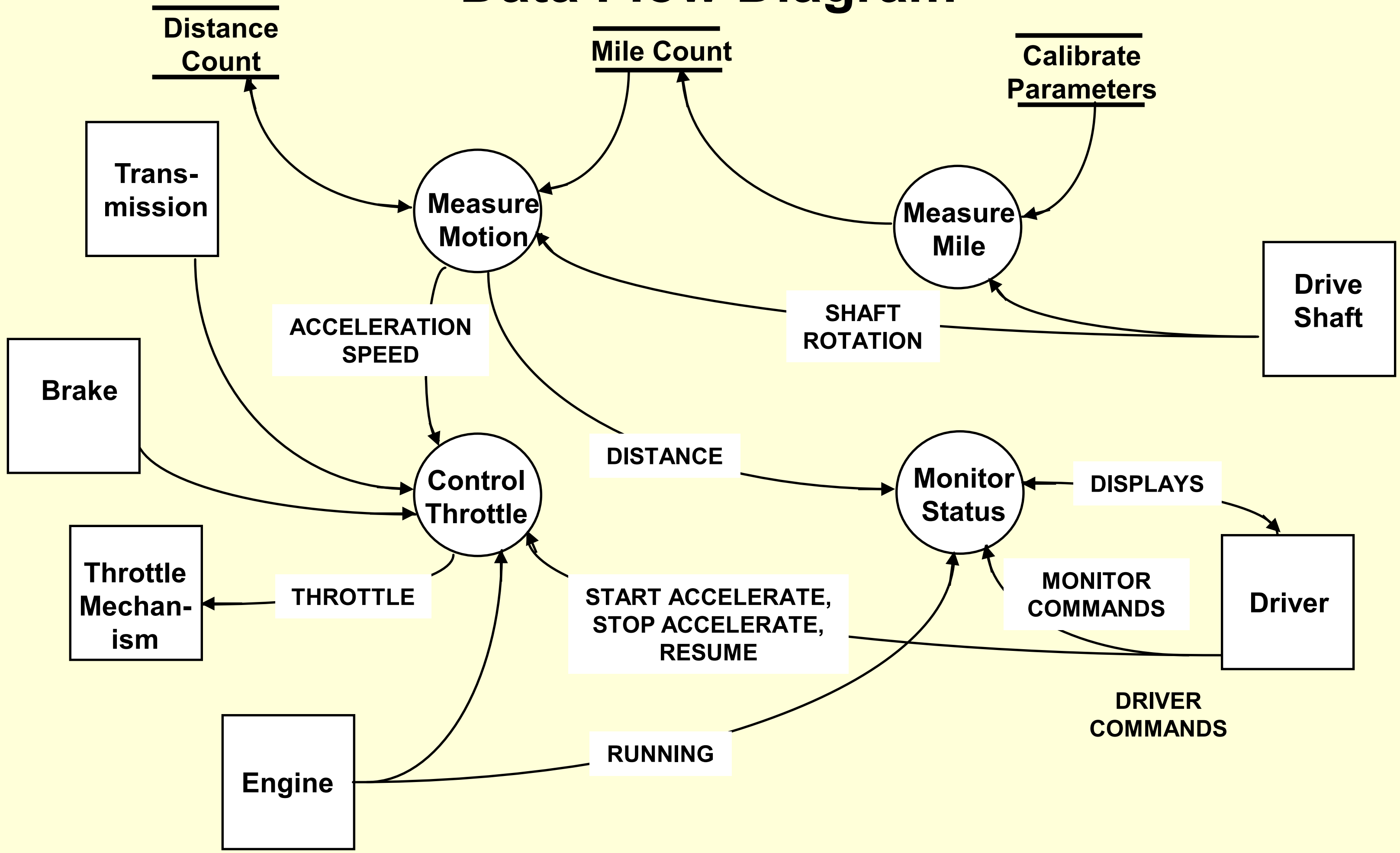
From Yourdon, "Modern Structured Analysis"

Modern Structured Analysis
Environmental Modeling Artifacts



Modern Structured Analysis

Data Flow Diagram



From Derek Hatley and Imitiaz Pirbhai, "Strategies For Real-Time System Specification", Dorset House, 1988

Modern Structured Analysis

Data Dictionary

- One data dictionary line item for each line or store on each DFD
- Name the data item and define it with mathematical precision

REQUIREMENTS (DATA) DICTIONARY

Name	Definition
ACCELERATION =	\Measured vehicle acceleration \Units: Miles per hour per second
ACTIVATE =	\Driver's cruse control activate command \2 Values: On, Off
DEFAULT COUNT =	\Constant = TBD; Default value of calibrated mile count \Units: Dimensionless

From Hatley, Pirbhai, "Strategies for Real-Time System Specification"

Modern Structured Analysis

Process Specification Examples

PSPEC 1.1 Measure Motion

For each pulse of SHAFT ROTATION

Add 1 to DISTANCE COUNT
then set:

DISTANCE = DISTANCE COUNT/MILE COUNT

At least once per second, measure pulse rate of SHAFT ROTATION in pulses per hour, and set:

SPEED = Pulse Rate/MILE COUNT

At least once per second, measure rate of change of SHAFT ROTATION pulses in pulses per hour, and set:

ACCELERATION = Rate of change/MILE COUNT

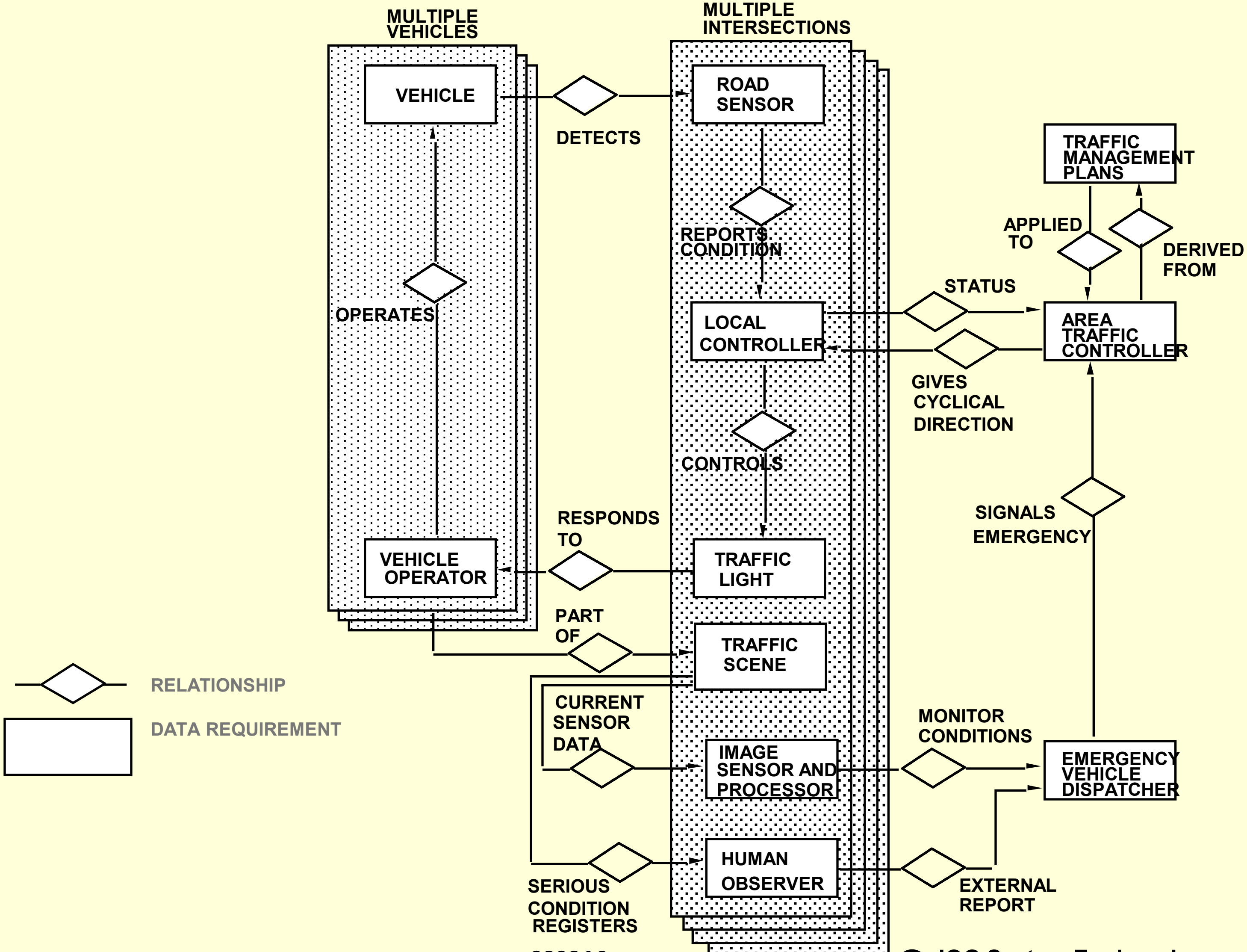
PSPEC 1.2 Measure Mile

Each time activated, start counting SHAFT ROTATION pulses

While LOWER LIMIT $\leq$ pulse count $\leq$ UPPER LIMIT
Set MILE COUNT = pulse count
Otherwise
Set MILE COUNT = DEFAULT COUNT

NOTE: All words in all-caps must be explained in dictionary.
From Hatley, Pirbhai, Strategies for Real-Time System Specification

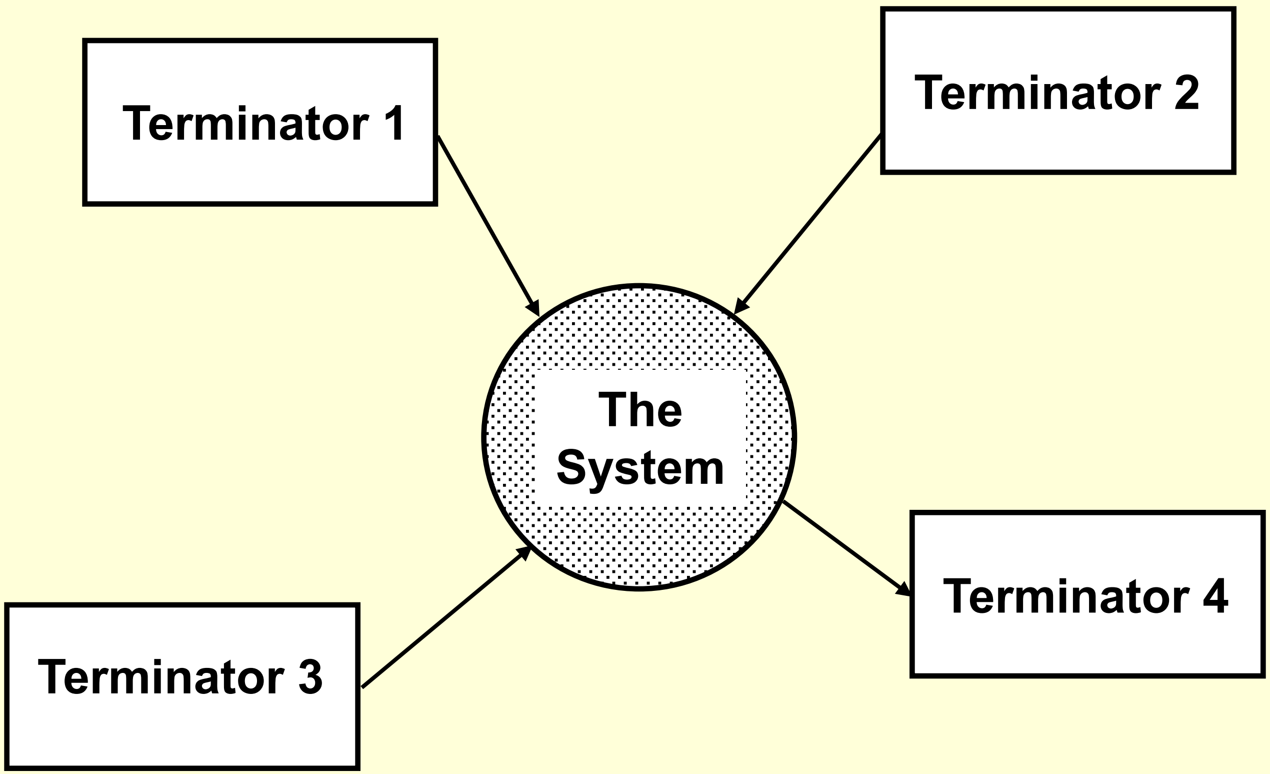
Entity Relationship Diagram (ERD)



PSARE

- Extension for MSA to better deal with real time control
- Formerly known as Hatley Pirbhai
- PSARE = Process for System Architecture and Requirements Engineering
- Also extends MSA into systems work
- PSARE is closest to a universal architecture description framework of all existing models

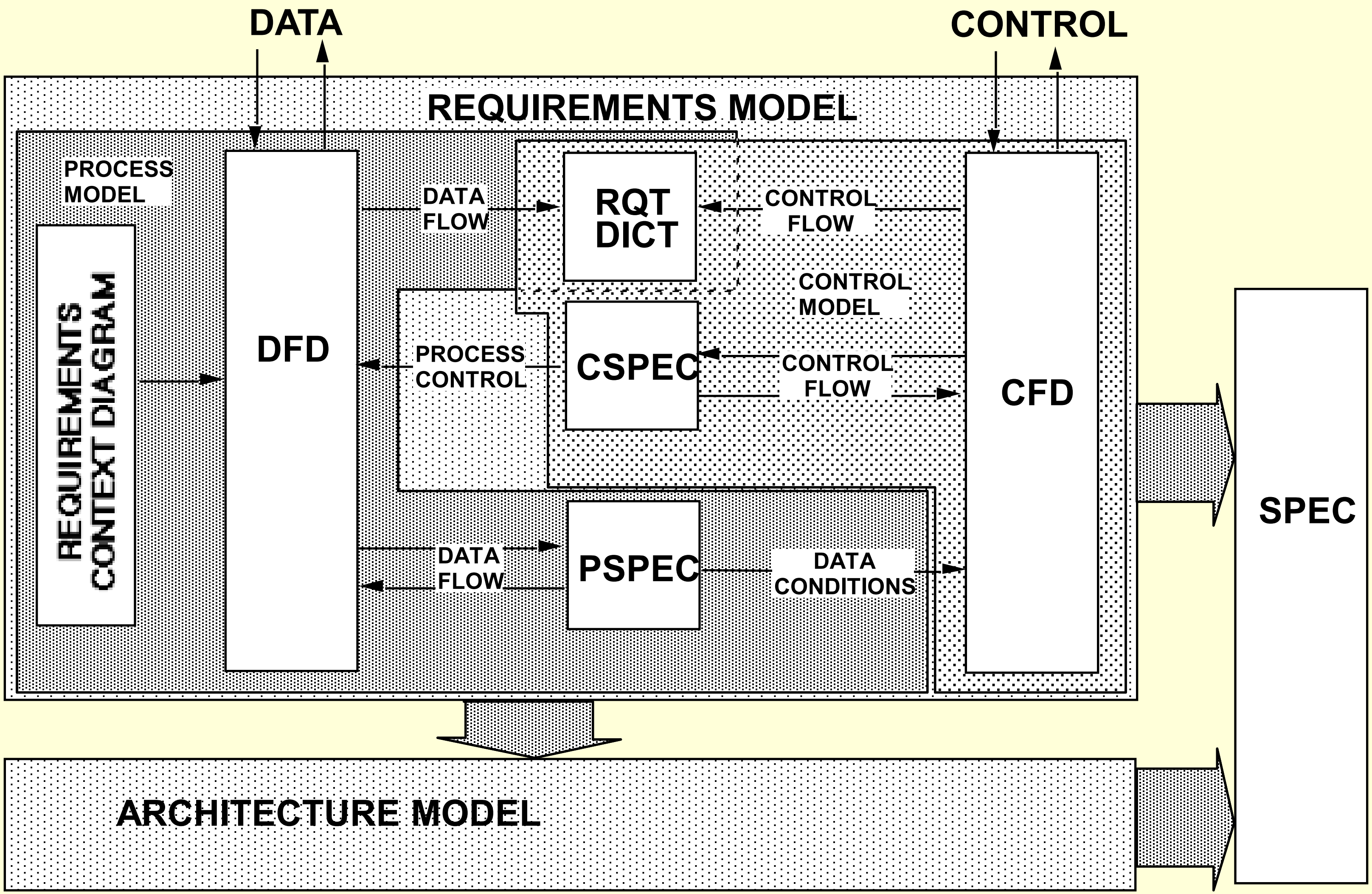
PSARE
Also Includes the Context Diagram



PSARE Delta

- **DFDs illustrate information, energy, or material processing within the system.**
  - One DFD for each process at a particular level.
  - Lower tier DFDs expand on the information represented by the parent process.
  - As a whole, a set of DFDs represent requirements statements at increasing levels of detail.
  - Data stores retain information from a flow after the source ceases sending it.
  - DFD processes may deal with discrete or continuous data.
- **PSPECs define each process in terms of the relationship between input and output.**
  - Brief, concise narrative descriptions of the functions of a process at lowest level of decomposition.
  - Can contain, text, diagrams, or structured English.
  - Represents the requirements of the process and not the design.
  - They correlate with the process bubbles on the DFD at the lowest tier.
- **CFDs illustrates what the process must do under any given conditions.**
  - CFD bubbles mirror the DFD structure.
  - CFD flows can be shown on one plane using dashed lines
  - Data conditions are control signals generated within PSPECs through tests on data.
  - Process controls are generated from logic in CSPECs and activate/deactivate DFD processes.
- **CSPECs define behavior needed to control the system.**
  - Control behavior defined in terms of finite state machines (combinatorial or sequential).
  - Inputs are control flows from CFDs.
  - Outputs are process activators and control flows into CFDs.
- **REQUIREMENTS (or Data) DICTIONARY defines all data and control elements.**
  - One line item for each flow on every DFD and CFD.

PSARE Requirements Model



PSARE

Requirements (Data) Dictionary

- One data dictionary line item for each line or store on each DFD
- Name the data item and precisely define it with mathematical precision

REQUIREMENTS (DATA) DICTIONARY

Name	Definition
ACCELERATION =	\Measured vehicle acceleration \Units: Miles per hour per second
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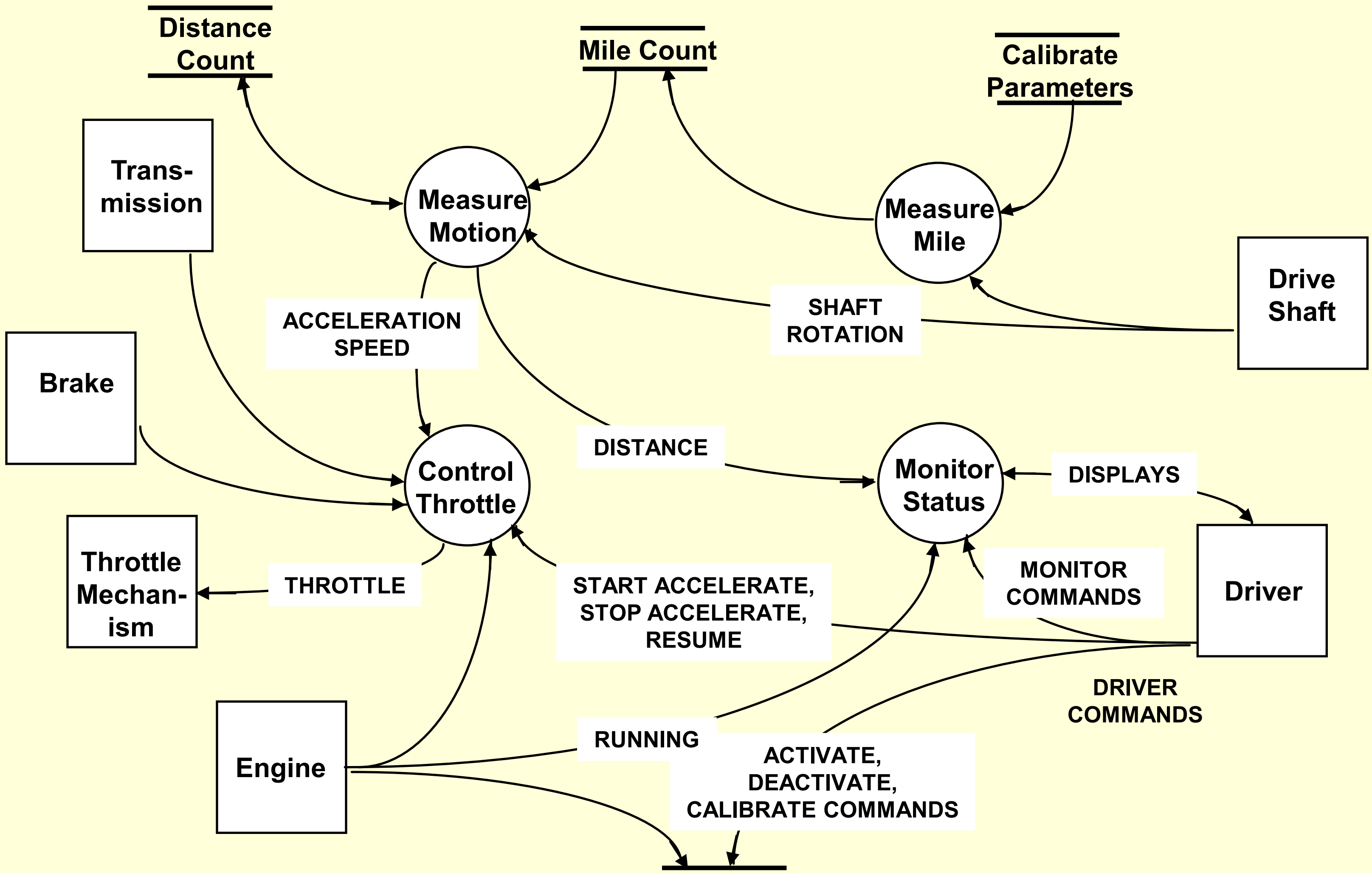
DEFAULT COUNT =	\Constant = TBD; Default value of calibrated mile count \Units: Dimensionless

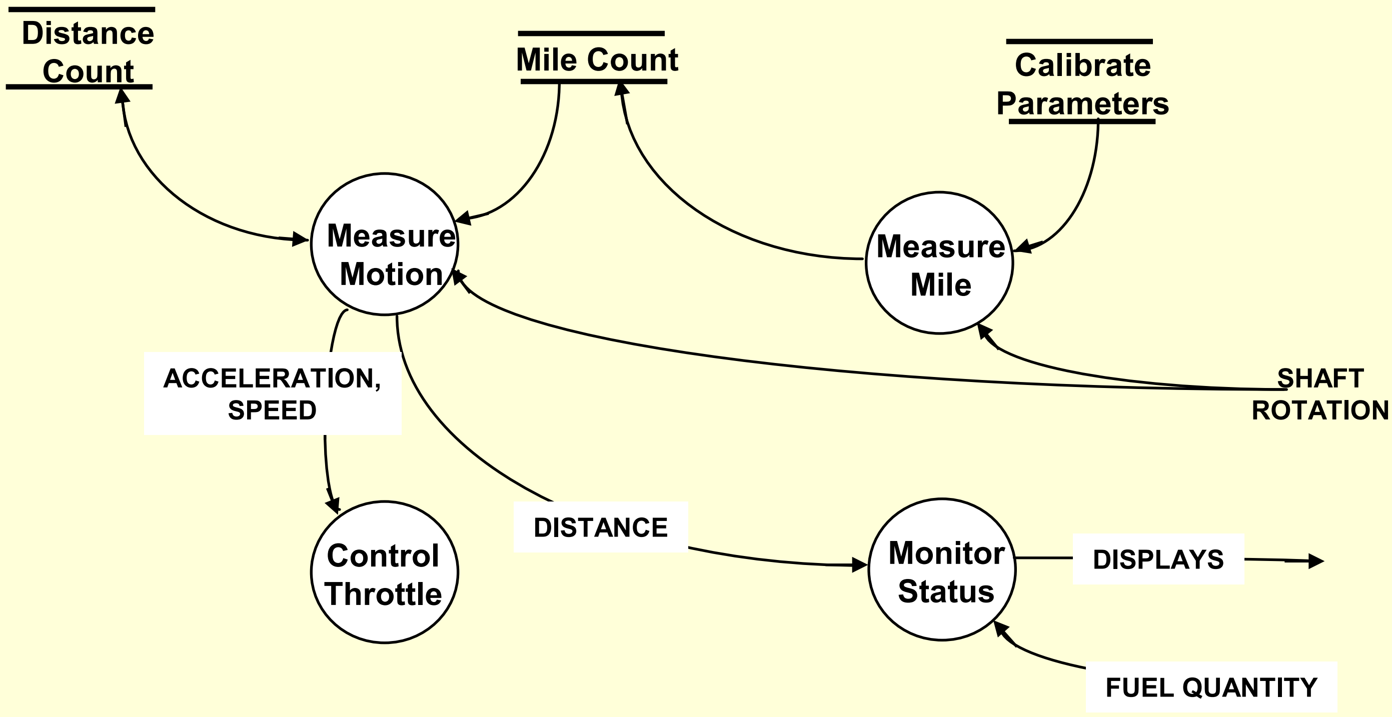
From Hatley, Pirbhai, "Strategies for Real-Time System Specification"

Combined DFD/CFD



From Derek Hatley and Imitiaz Pirbhai, "Strategies For Real-Time System Specification", Dorset House, 1988

PSARE
Isolated DFD



From Derek Hatley and Imitiaz Pirbhai, "Strategies For Real-Time System Specification, Dorset House", 1988

PSARE

Process Specification Examples

PSPEC 1.1 Measure Motion

For each pulse of SHAFT ROTATION

Add 1 to DISTANCE COUNT then set:

DISTANCE = DISTANCE COUNT/MILE COUNT

At least once per second, measure pulse rate of SHAFT ROTATION in pulses per hour, and set:

SPEED = Pulse Rate/MILE COUNT

At least once per second, measure rate of change of SHAFT ROTATION pulses in pulses per hour, and set:

ACCELERATION = Rate of change/MILE COUNT

PSPEC 1.2 Measure Mile

Each time activated, start counting SHAFT ROTATION pulses

While LOWER LIMIT $\leq$ pulse count $\leq$ UPPER LIMIT

Set MILE COUNT = pulse count

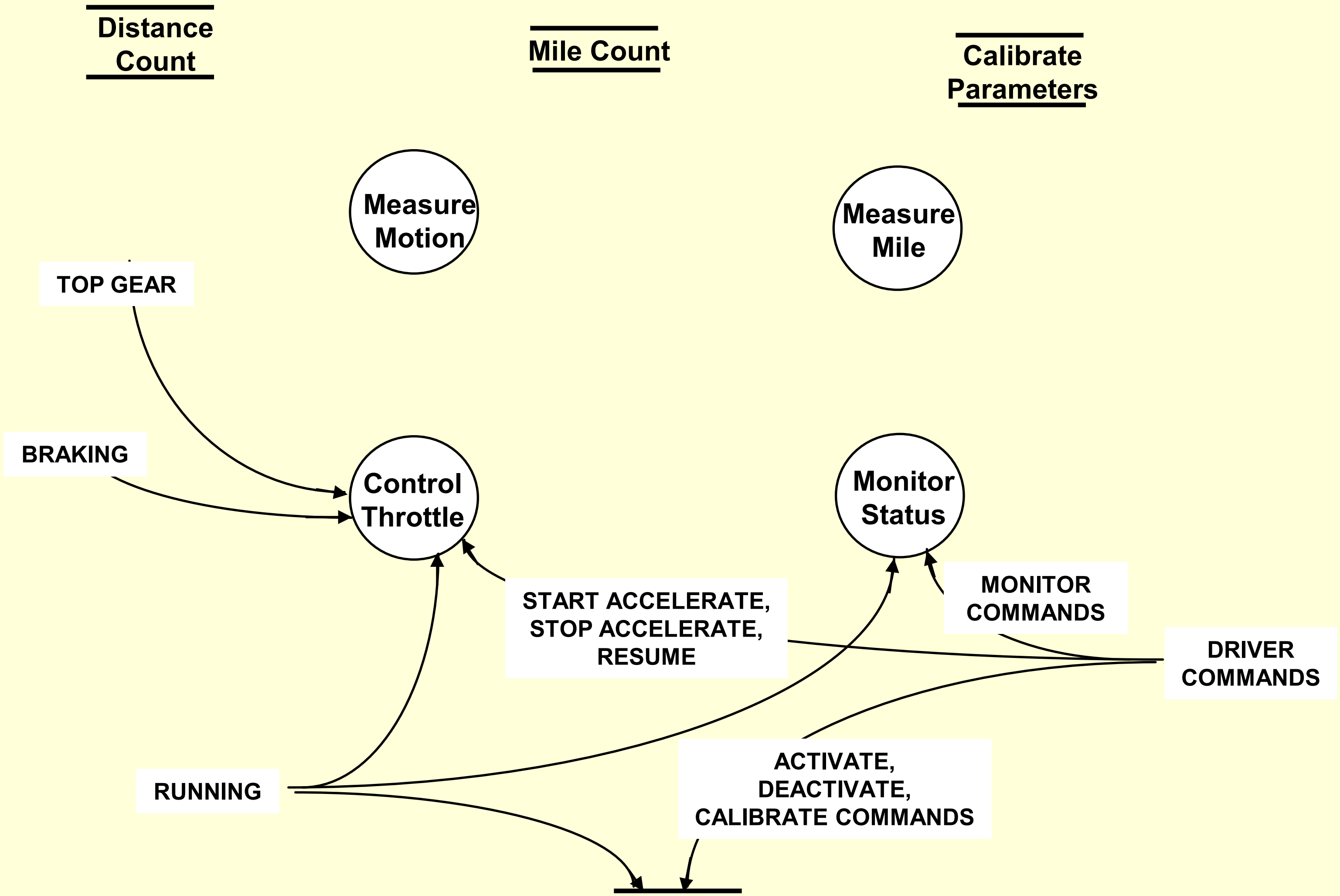
Otherwise

Set MILE COUNT = DEFAULT COUNT

NOTE: All words in all-caps must be explained in dictionary.

From Hatley, Pirbhai, "Strategies for Real-Time System Specification"

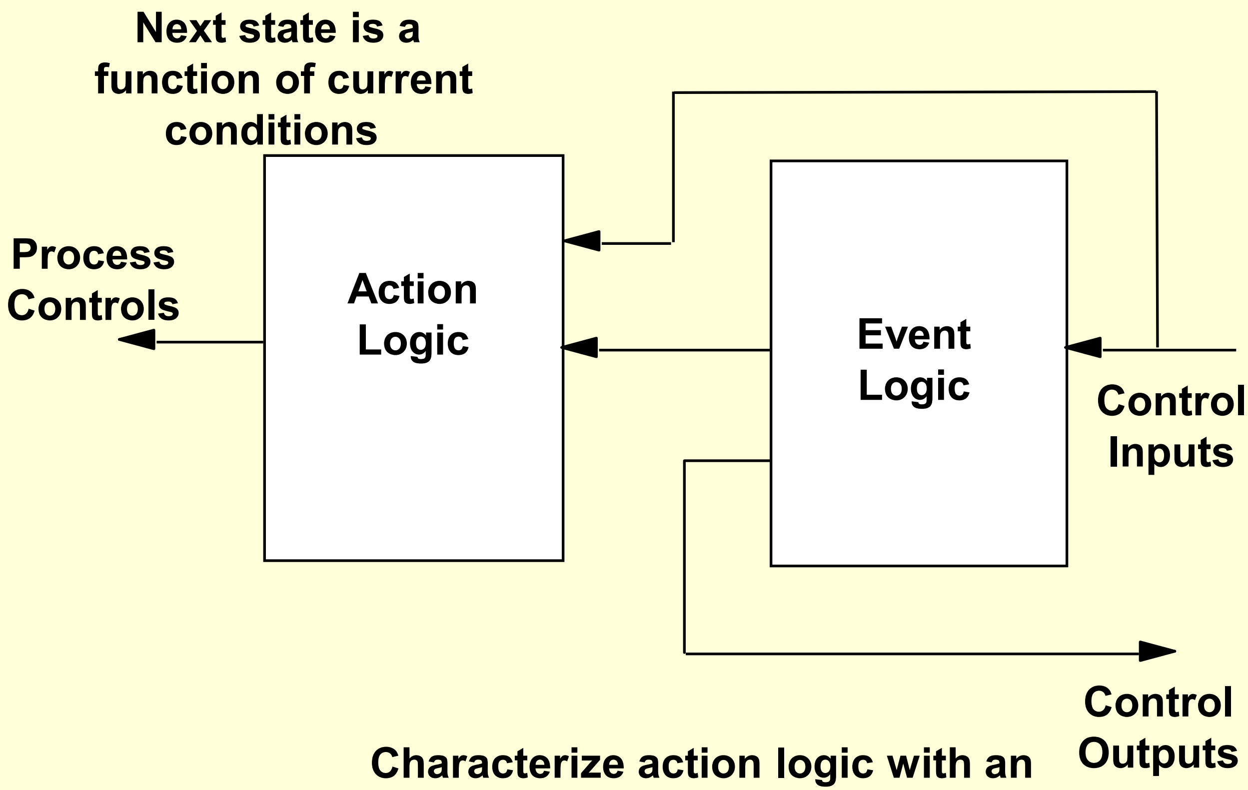
PSARE
Isolated CFD



From Derek Hatley and Imitiaz Pirbhai, "Strategies For Real-Time System Specification", Dorset House, 1988

PSARE

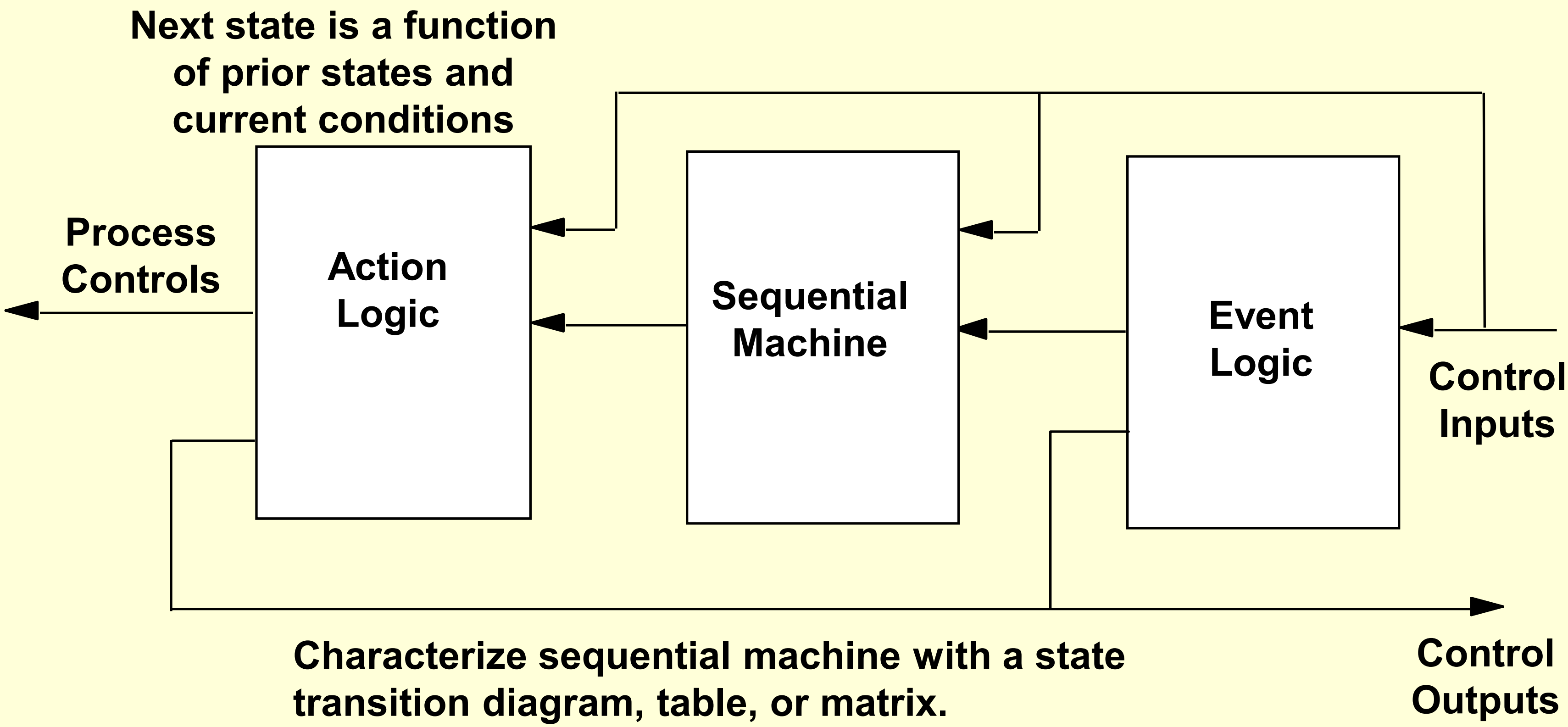
C-Specs - Generic Combinational Machine



Characterize action logic with an activation table and the event logic with a decision table.

PSARE

CSpec - Generic Sequential Machine

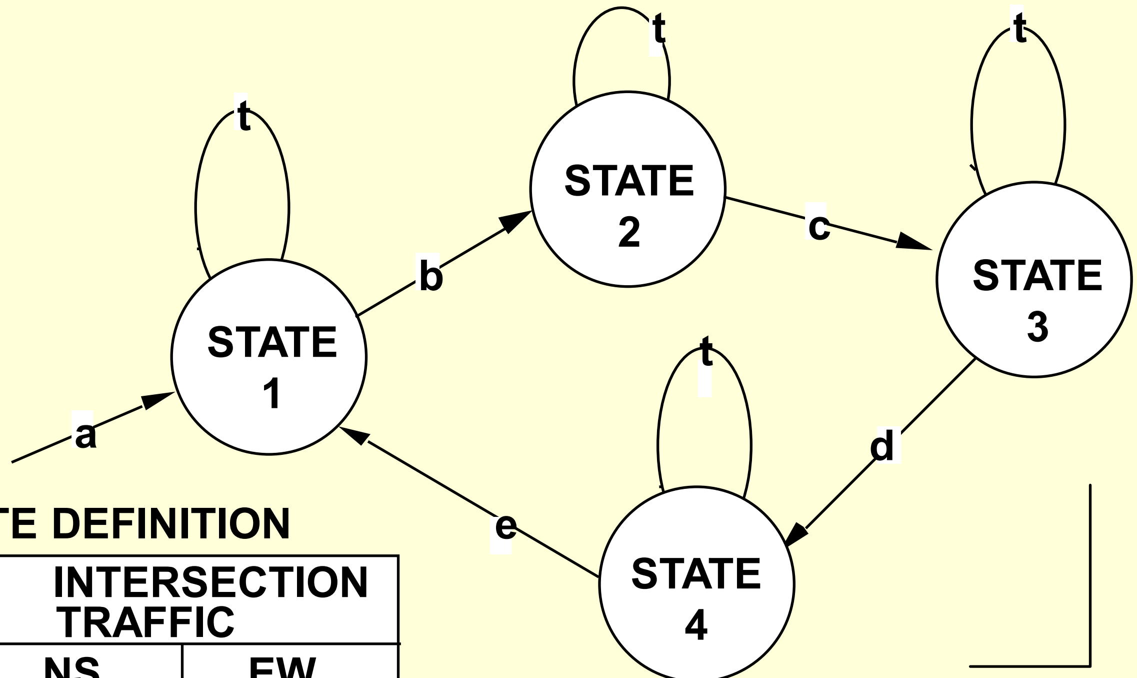


Characterize sequential machine with a state transition diagram, table, or matrix.

Characterize action logic with an activation table and the event logic with a decision table.

PSARE

State Transition Diagram

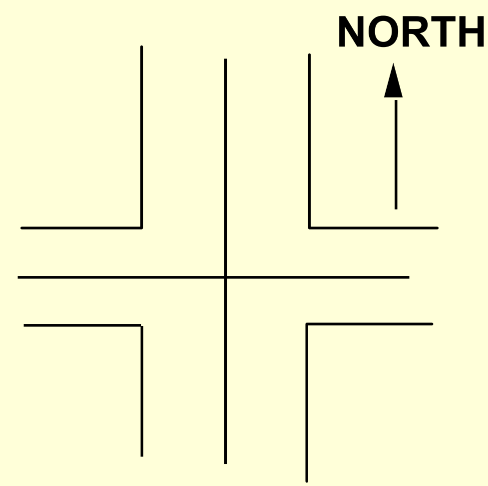


STATE DEFINITION

STATE	INTERSECTION TRAFFIC NS	INTERSECTION TRAFFIC EW
1	GREEN	RED
2	ORANGE	RED
3	RED	GREEN
4	RED	ORANGE

TRANSITION RULES

a=Power On
b=State 1 AND 120t
c=State 2 AND 10t
d=State 3 AND 60t
e=State 4 AND 10t
t=timing pulse @ 60Hz



REAL WORLD
SITUATION

PSARE

Decision Table

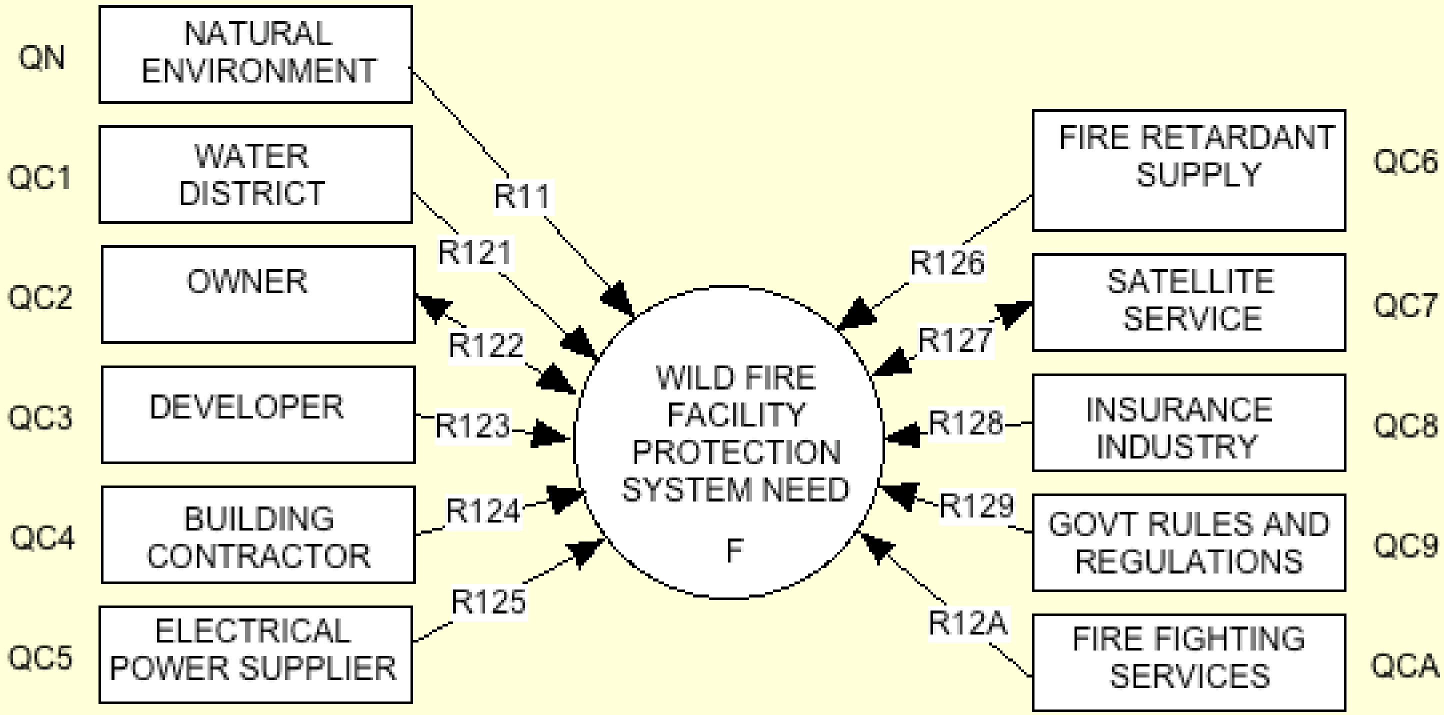
- **Define inputs**
- **Determine all possible values of each input**
- **Determine output results desired for each input condition**
- **Review for impossible input combinations**
- **Review for combinations that can be grouped**

MODE	INPUTS		OUTPUTS	
	TEMP	PRESS	HEATER	PUMP
IDLE	HIGH	HIGH	OFF	OFF
		LOW	OFF	OFF
	LOW	HIGH	OFF	OFF
		LOW	OFF	OFF
AUTO 1	HIGH	HIGH	OFF	OFF
		LOW	OFF	ON
	LOW	HIGH	ON	OFF
		LOW	ON	ON
AUTO 2	HIGH	HIGH	OFF	OFF
		LOW	OFF	ON
	LOW	HIGH	ON	OFF
		LOW	ON	OFF

ONLY FOUR POSSIBLE OUTPUTS:
Both Pump And Heater Off
Both Heater And Pump On
Heater On, Pump Off (May Be Dangerous)
Heater Off, Pump On

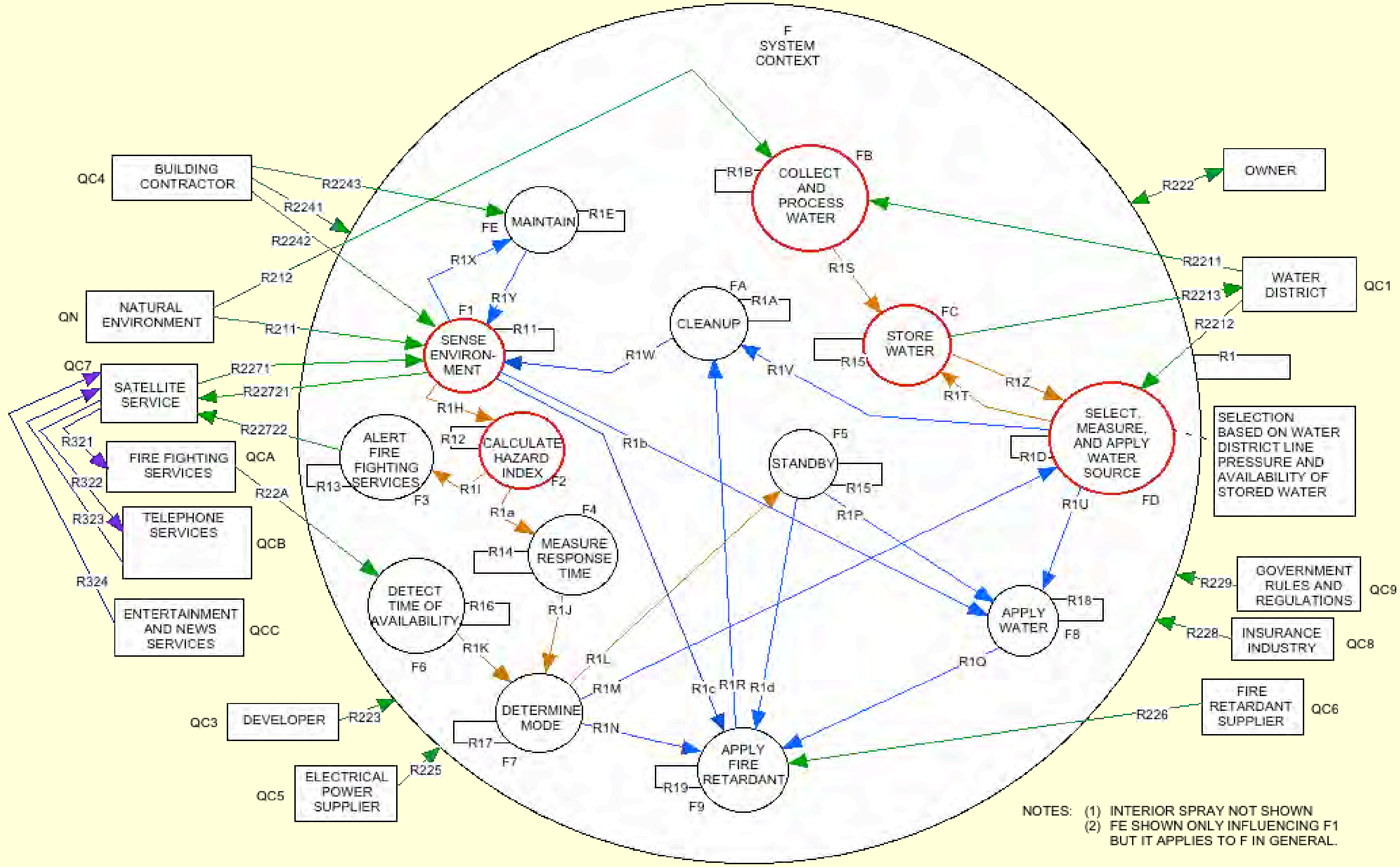
PSARE

Sample System Analysis - The Context Diagram



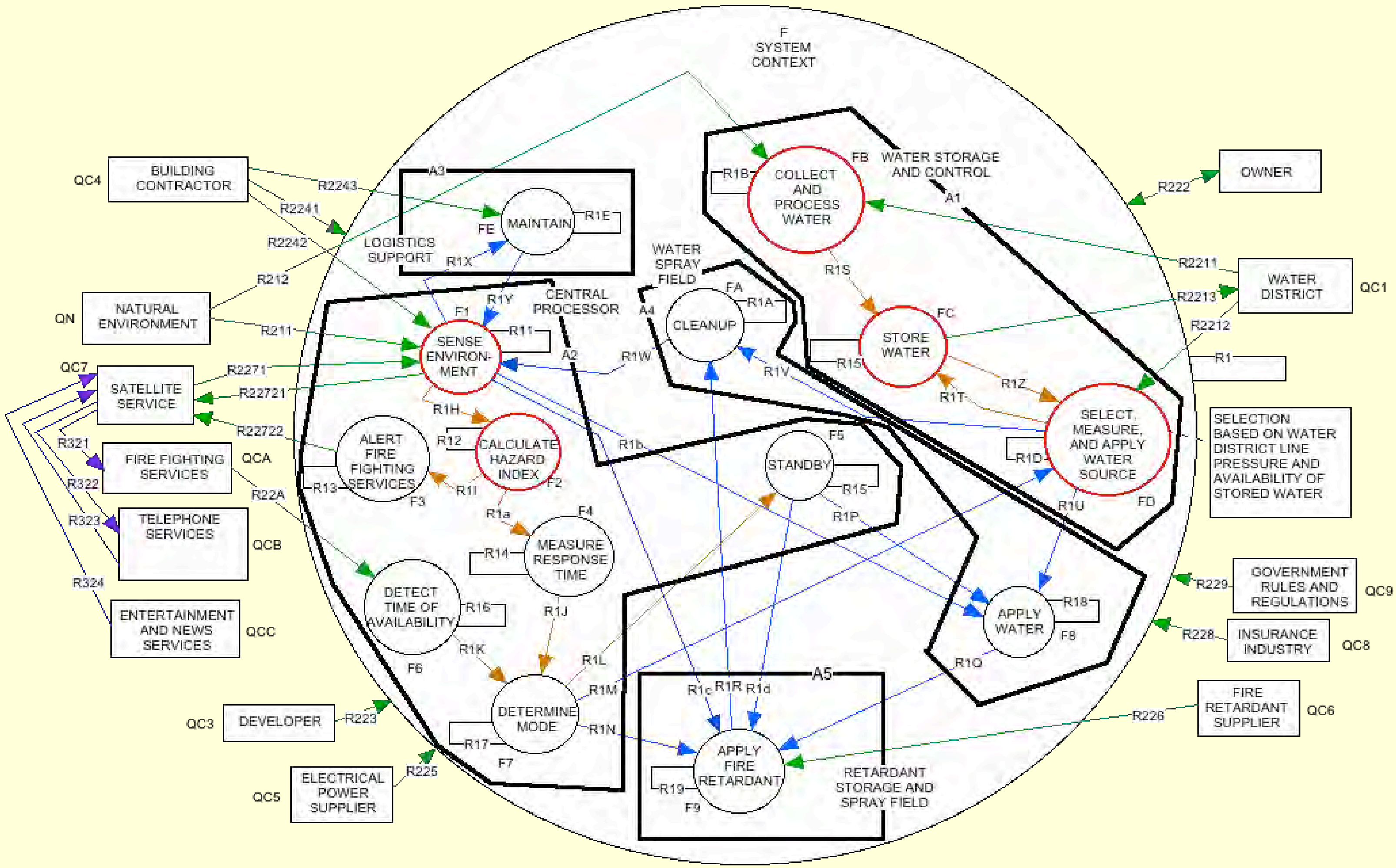
PSARE

Sample System Analysis – Context Diagram Expansion



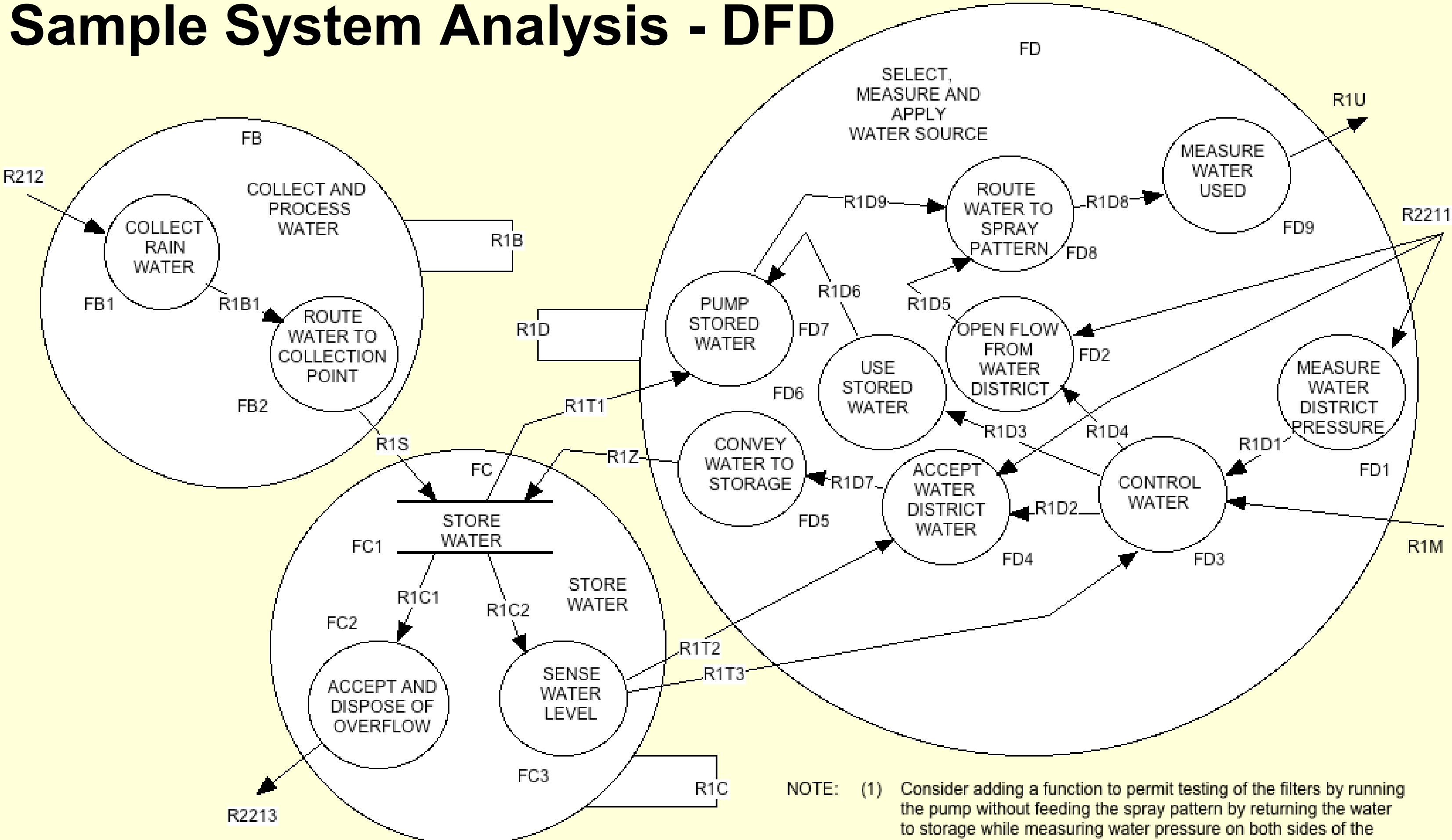
PSARE

Sample System Analysis - Super Bubbles



PSARE

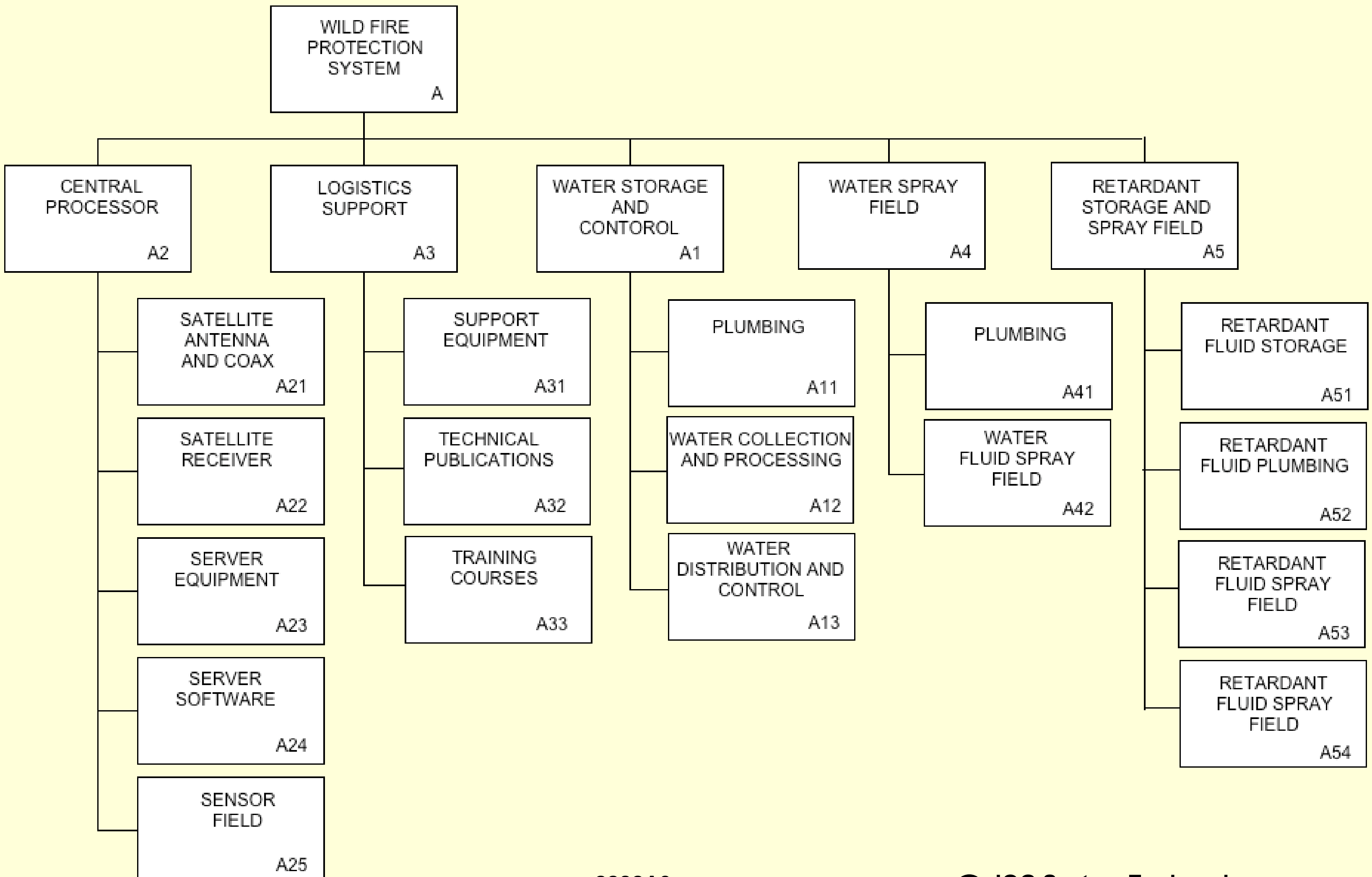
Sample System Analysis - DFD



NOTE:
(1) Consider adding a function to permit testing of the filters by running the pump without feeding the spray pattern by returning the water to storage while measuring water pressure on both sides of the filters. A high pressure indication should be logged for an early maintenance response.
(2) Consider adding a function and relationship that directs the water flow from function FD8 onto the facility from the direction of the fire rather than from all directions.
(3) Water used must be measured before the spray pattern rather than after.

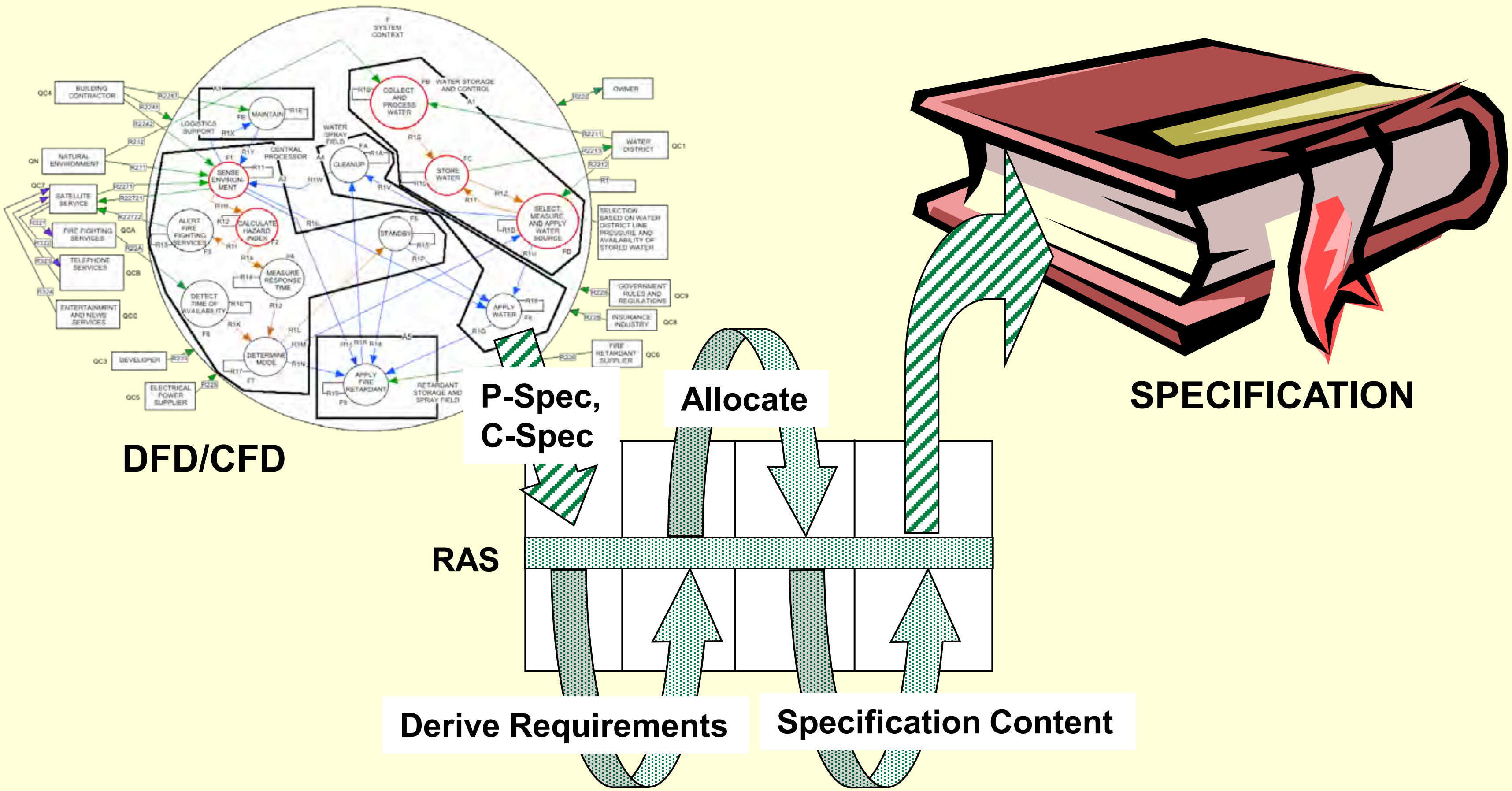
PSARE

Common Product Entity Structure



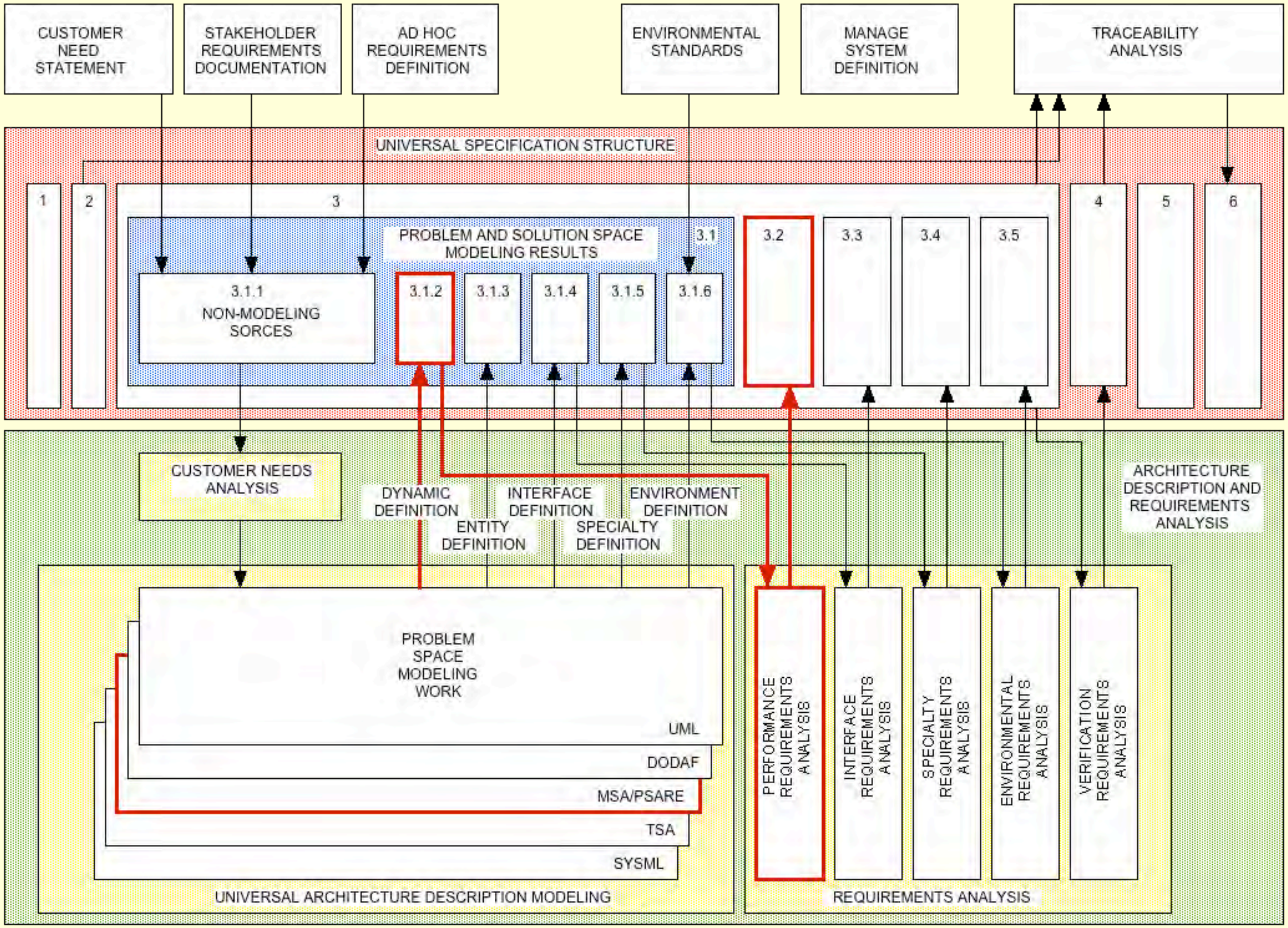
PSARE

The Requirements Dictionary is the RAS



PSARE

Deriving Specification Content



Continue Reading About MSA and PSARE

- Tom DeMarco, "Structured Analysis and System Specification",1979
- Edward Yourdon and Larry Constantine, "Structured Design", Prentice hall, 1979
- Victor Weinberg, "Structured Analysis", Yourdon Press, 1980
- Edward Yourdon, "Modern Structured Analysis", Yourdon Press, 1989
- Derek Hatley, Peter Hruschka, and Imtiaz Pirbhai, Process For System Architecture and Requirements Engineering", Dorset House, 2000

JOG SYSTEM ENGINEERING
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TUTORIAL

UNIVERSAL ARCHITECTURE DESCRIPTION FRAMEWORK

UML-SysML OVERVIEW AND UADF CONSTRUCT

UML-SysML UADF Components

- Hardware Models
  - Traditional Structured Analysis
  - SysML
- Computer Software Models
  - Process-oriented analysis
    - Flow charting
    - Modern Structured Analysis
    - PSARE
  - Data-oriented analysis
    - Table normalizing
    - IDEF-1X
  - Object-oriented analysis
    - Early models
    - UML
  - DoD architecture framework

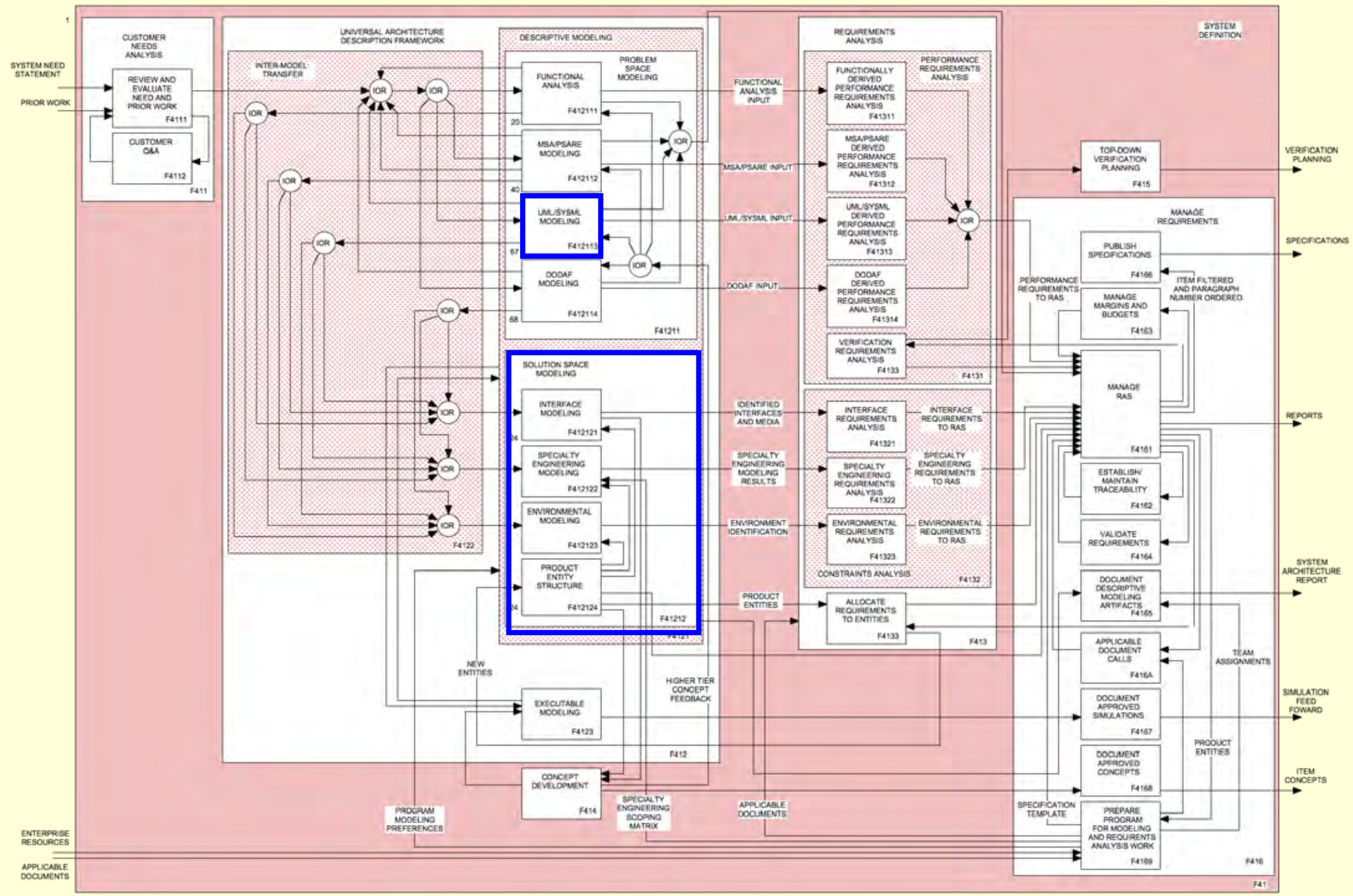
Benefits of SysML/UML UADF

- Top-Down
- Respect for Sullivan (dynamic opening)
- Seamless HW/SW switch
- Thoroughly modern
- Well supported by tool companies

UML and TSA
Not Too Far Apart Actually

<table>
<tr><td colspan="9">UNIFIED MODELING LANGUAGE (UML)</td></tr>
<tr><td colspan="3">STATIC REPRESENTATION</td><td colspan="6">DYNAMIC REPRESENTATION</td></tr>
<tr><td rowspan="2">DEPLOY-MENT DIAGRAM</td><td rowspan="2">COMPONENT DIAGRAM</td><td rowspan="2">OBJECT & CLASS DIAGRAMS</td><td rowspan="2">STATE CHART</td><td rowspan="2">USE CASE DIAGRAM</td><td colspan="2">INTERACTION DIAGRAMS</td><td rowspan="2">ACTIVITY DIAGRAM</td></tr>
<tr><td>COMMUNI-CATION DIAGRAM</td><td>SEQUENCE DIAGRAM</td></tr>
<tr><td colspan="3">PRODUCT ENTITY BLOCK DIAGRAM</td><td>STATE DIAGRAM</td><td colspan="2">SCHEMATIC BLOCK DIAGRAM</td><td>TIMELINE DIAGRAM</td><td>FUNCTIONAL FLOW DIAGRAM</td></tr>
<tr><td colspan="3">PHYSICAL FACET</td><td colspan="4">BEHAVIORAL FACET</td><td>FUNCTION-AL FACET</td></tr>
<tr><td colspan="8">TRADITIONAL STRUCTURED ANALYSIS (TSA)</td></tr>
</table>

SysML/UML UADF With Common Solution Space Models



The Diagrams of UML 2.0

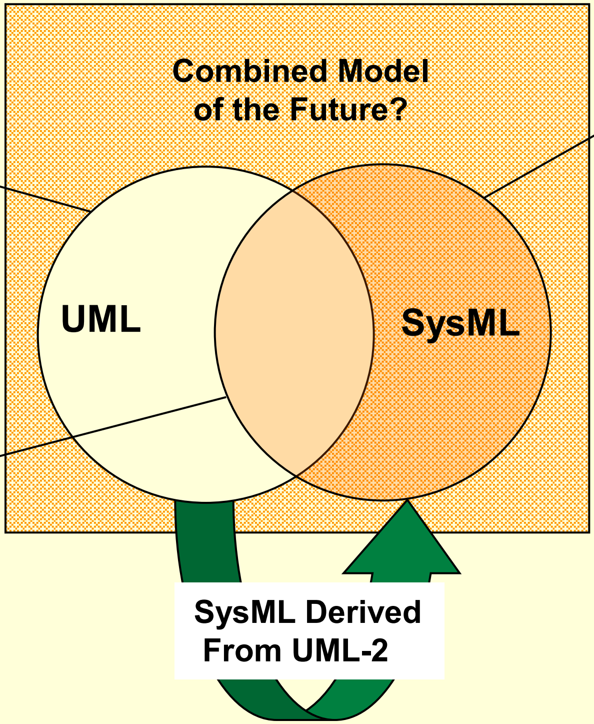
- For modeling dynamic parts of the system
  - ✓ Use case diagram
  - ✓ Sequence diagram
  - – Timing diagram
  - ✓ Communication diagram (renamed in 2)
  - ✓ State diagram
  - ✓ Activity diagram
  - – Interaction overview diagram (2)
- For modeling static parts of the system
  - ✓ Object and class diagrams
  - ✓ Component diagram
  - ✓ Deployment diagram
  - – Composite structure diagram (2)
  - – Package diagram (2)

(2) = added in UML 2.0
✓ Diagrams discussed in tutorial

The Diagrams in UML and SysML

UML-2 Only

Object/Class Diagram
Component Diagram
Deployment Diagram
Communication Diagram
Interaction Overview Diagram
Composite Structure Diagram



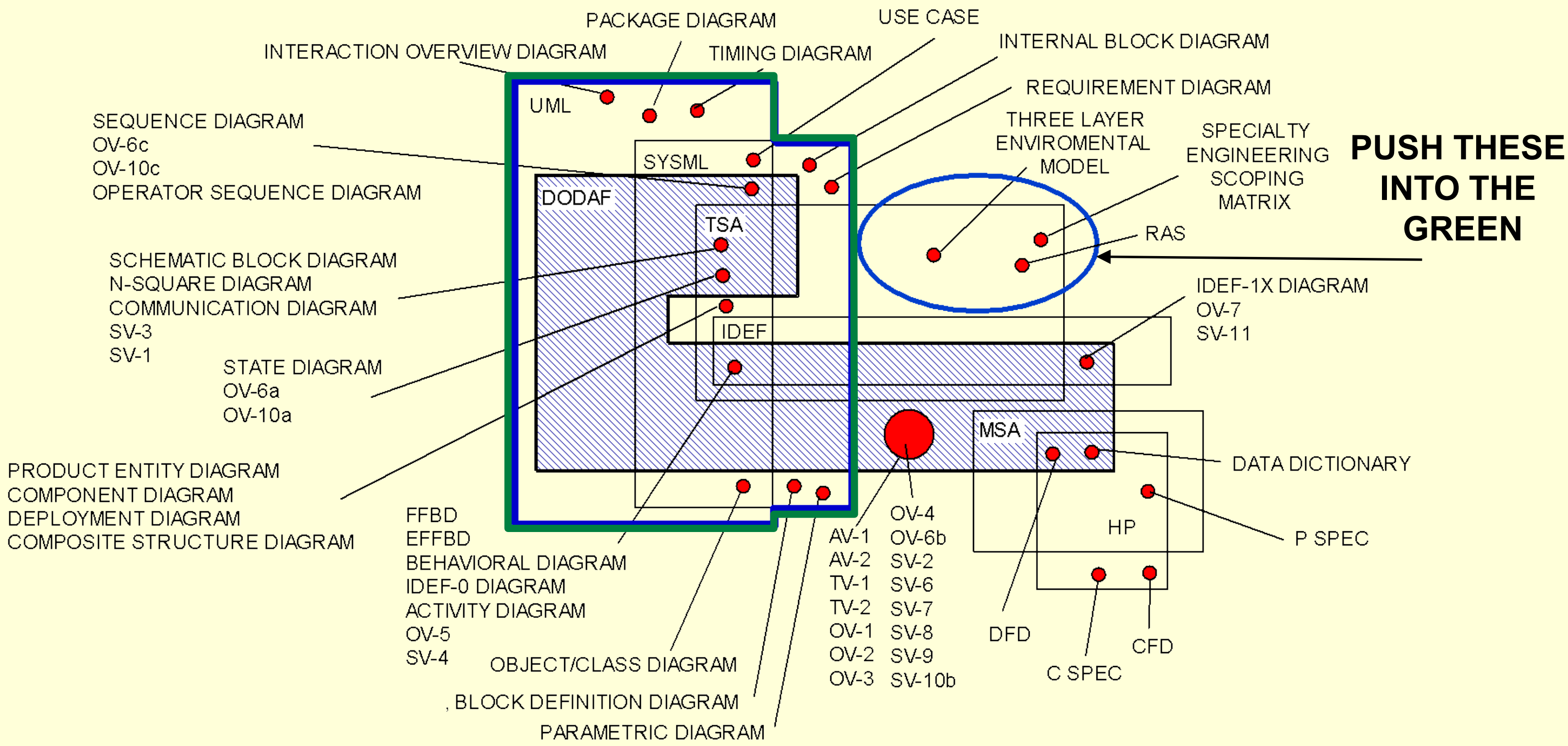
SysML Only

Requirement Diagram
Parametric Diagram
Block Definition Diagram
Internal Block Diagram

Common Diagrams

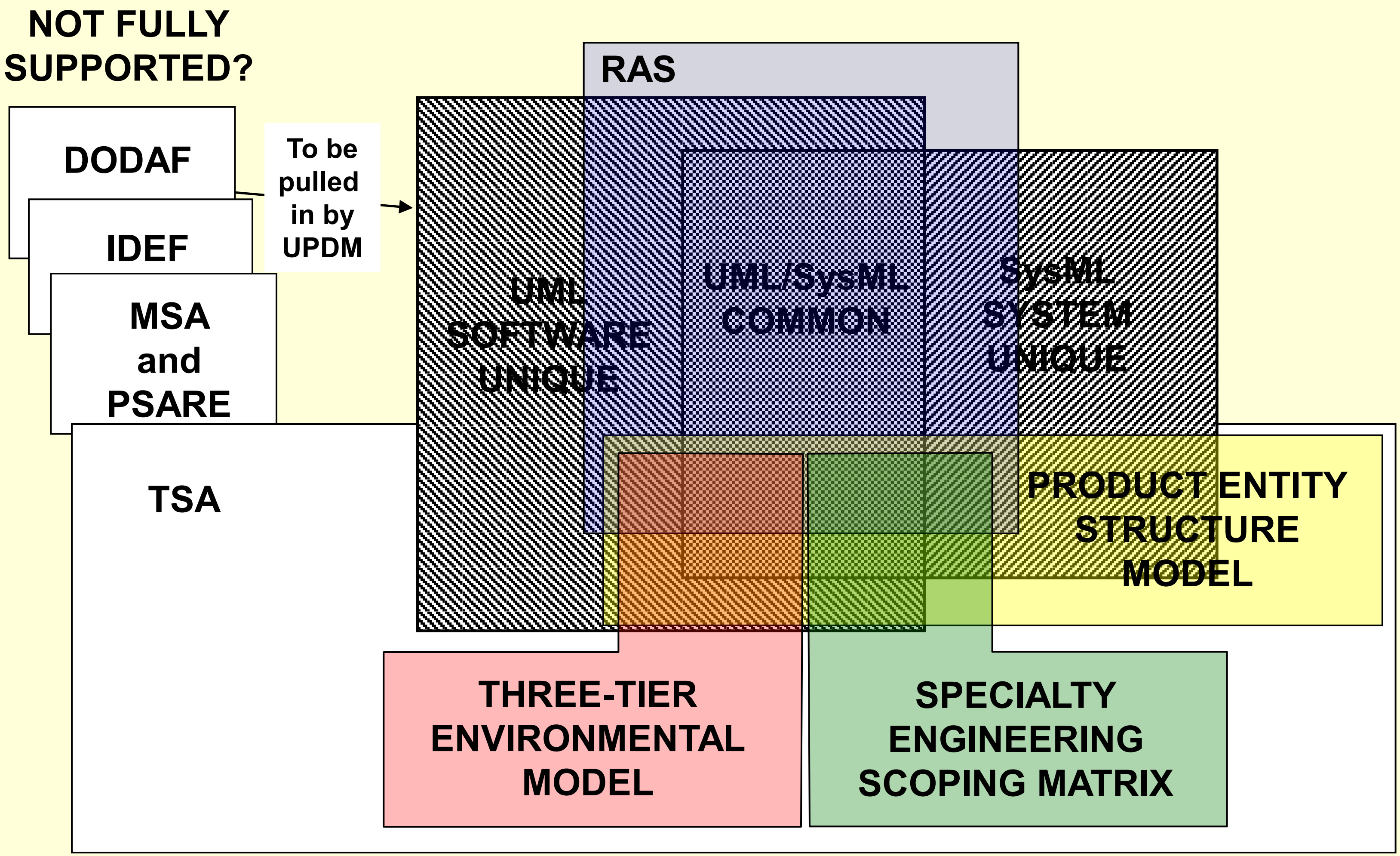
Use Case Diagram
Activity Diagram
State Diagram
Sequence Diagram
Package Diagram
Timing Diagram

Toward a Universal Model
Using UML-SysML Modeling Artifacts

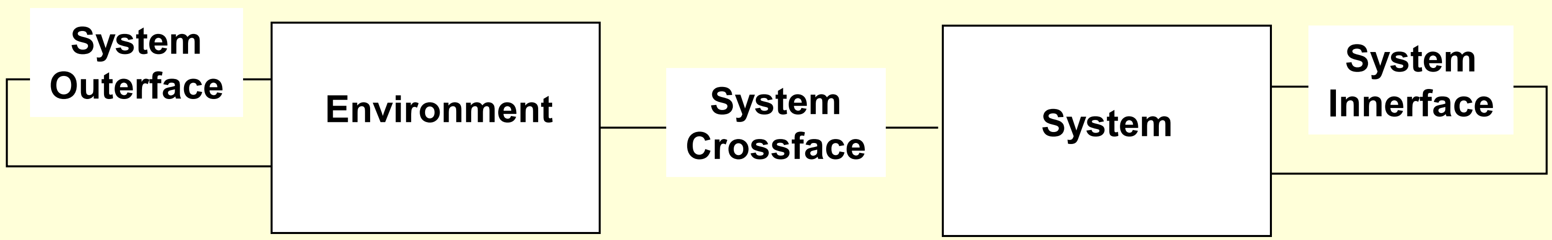


UML-SysML Model Combination

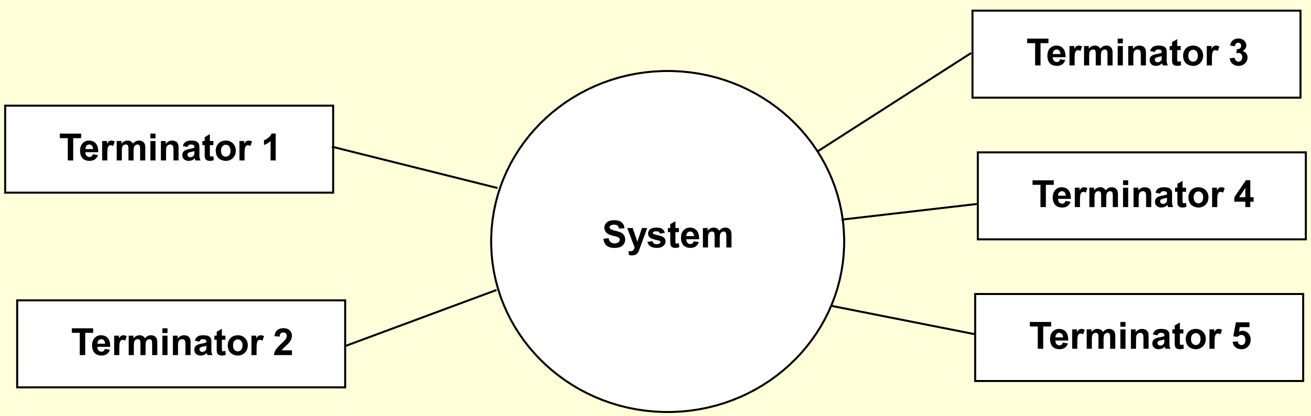
A Universal Model for the Future?



Two Older Inside-Outside Views of Systems



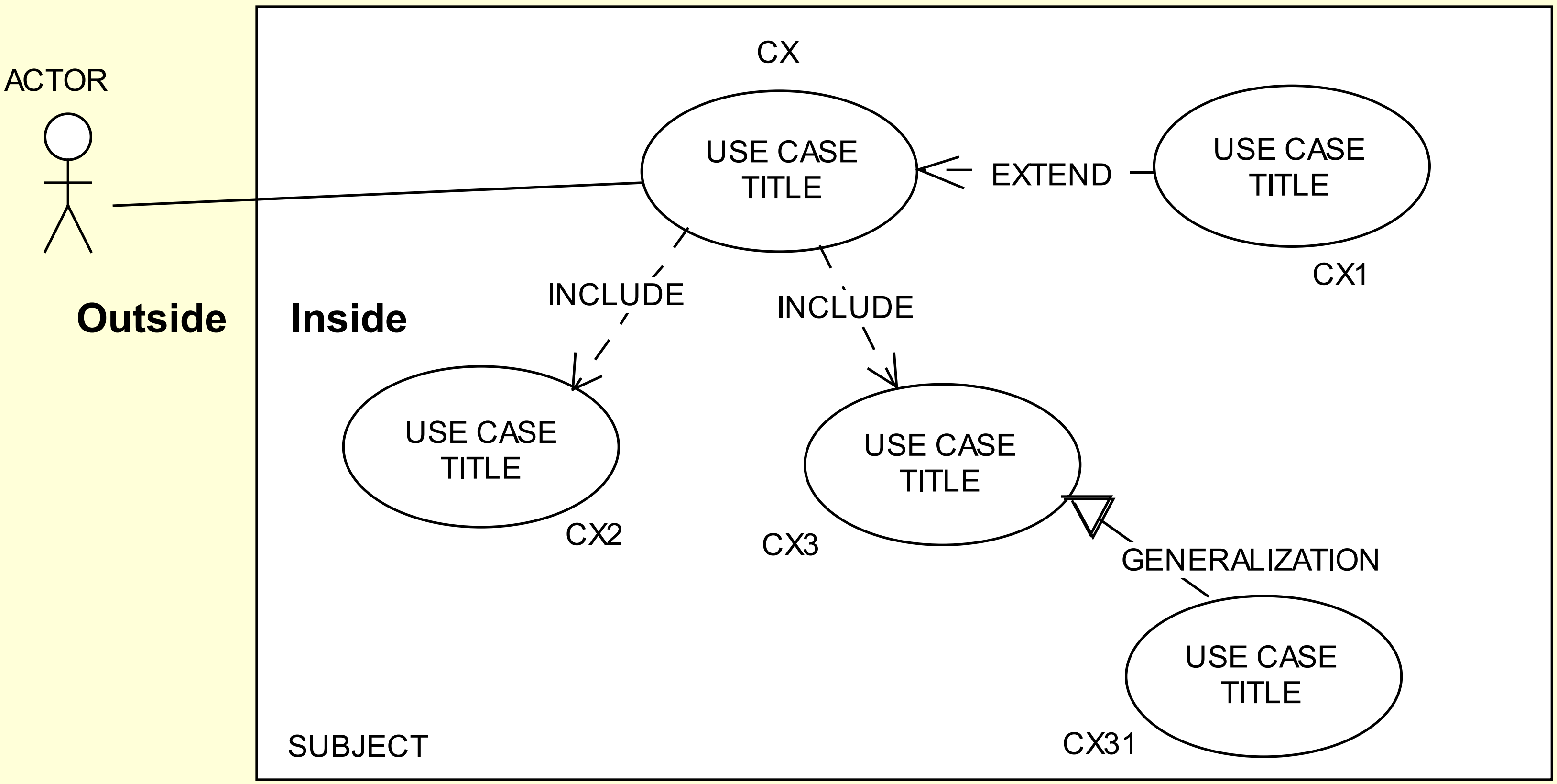
The Traditional Structured Analysis View of a System



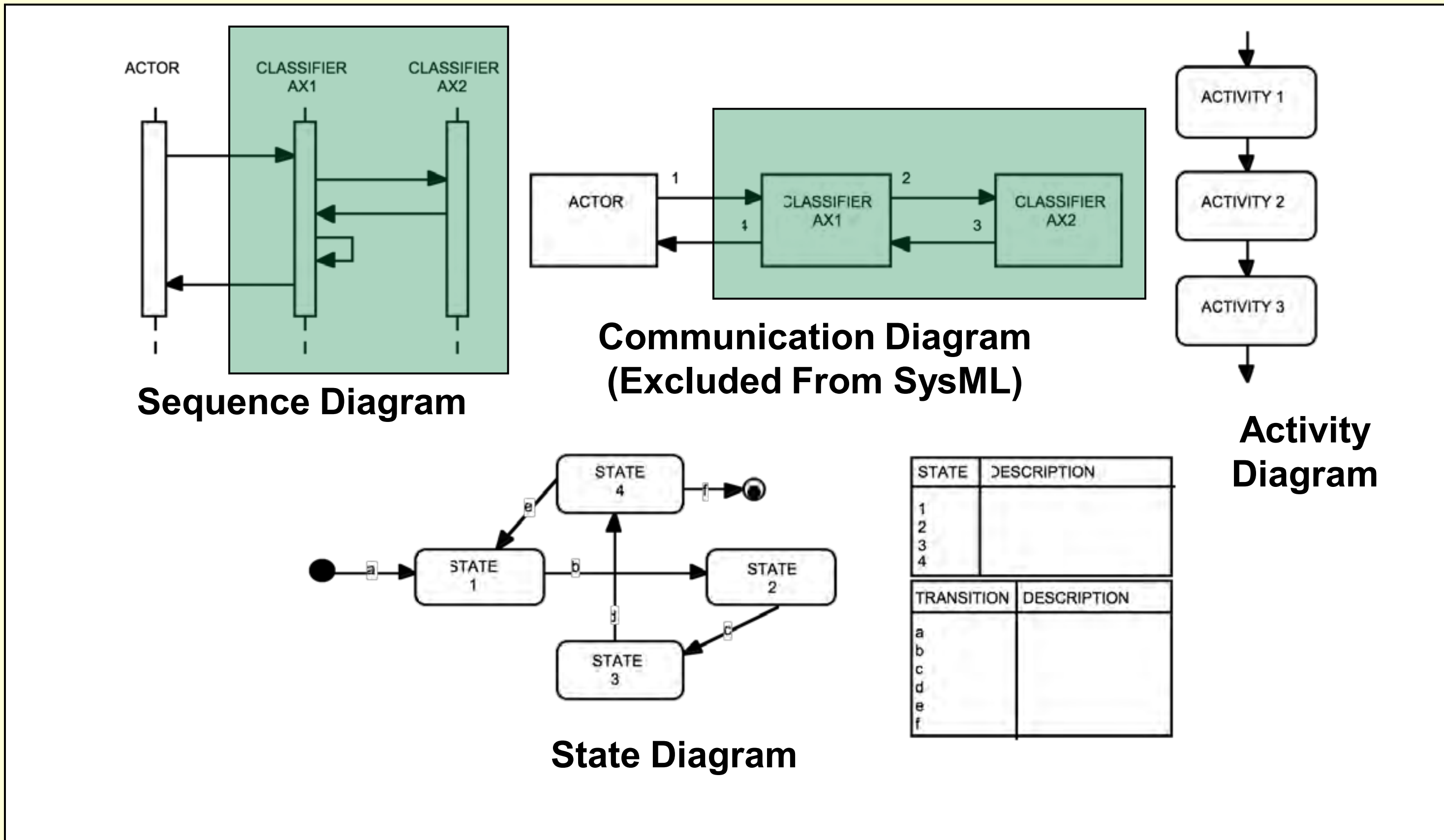
The Modern Structured Analysis View of a System
The Context Diagram

Use Cases

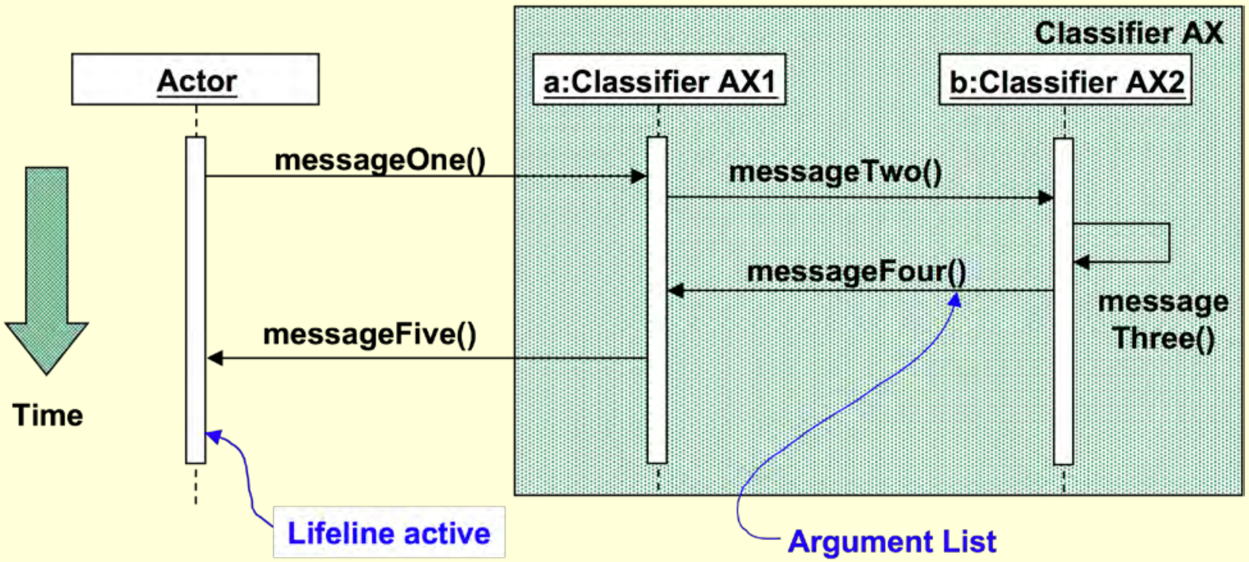
The UML-SysML View of a System



UML-SysML Dynamic Modeling Artifacts

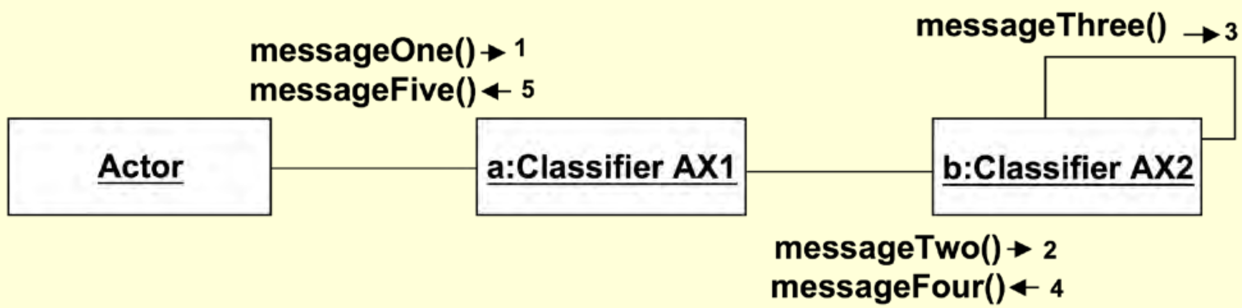


Sequence Diagram



Covers messages between entities but can't handle material or energy relationships in UML. Can do in SysML.

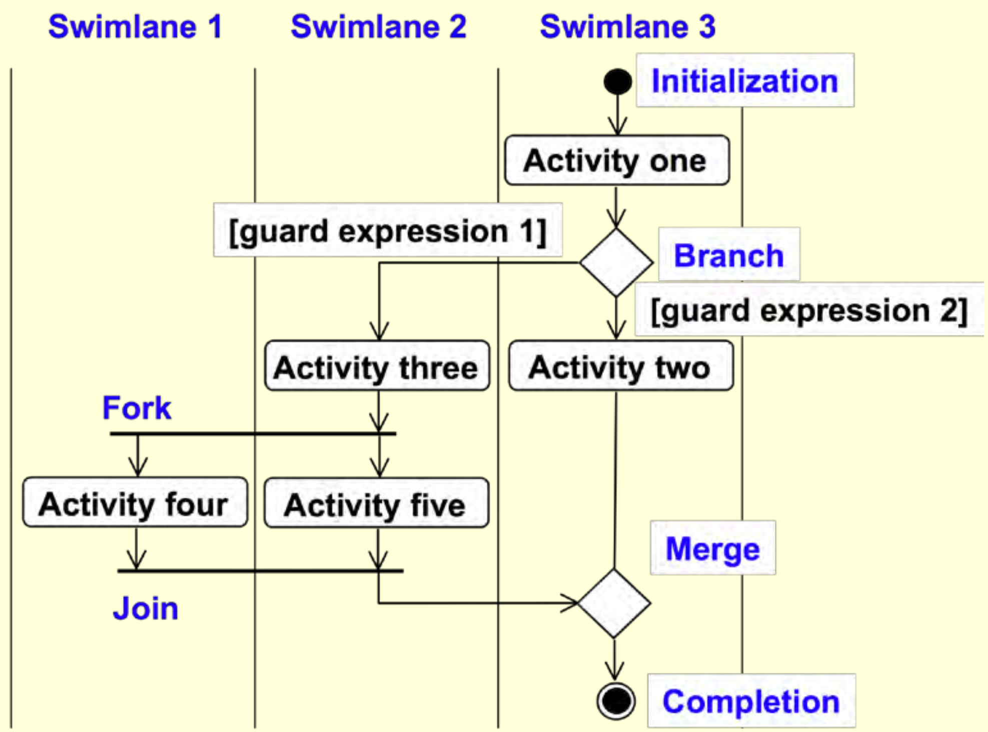
Communication Diagram



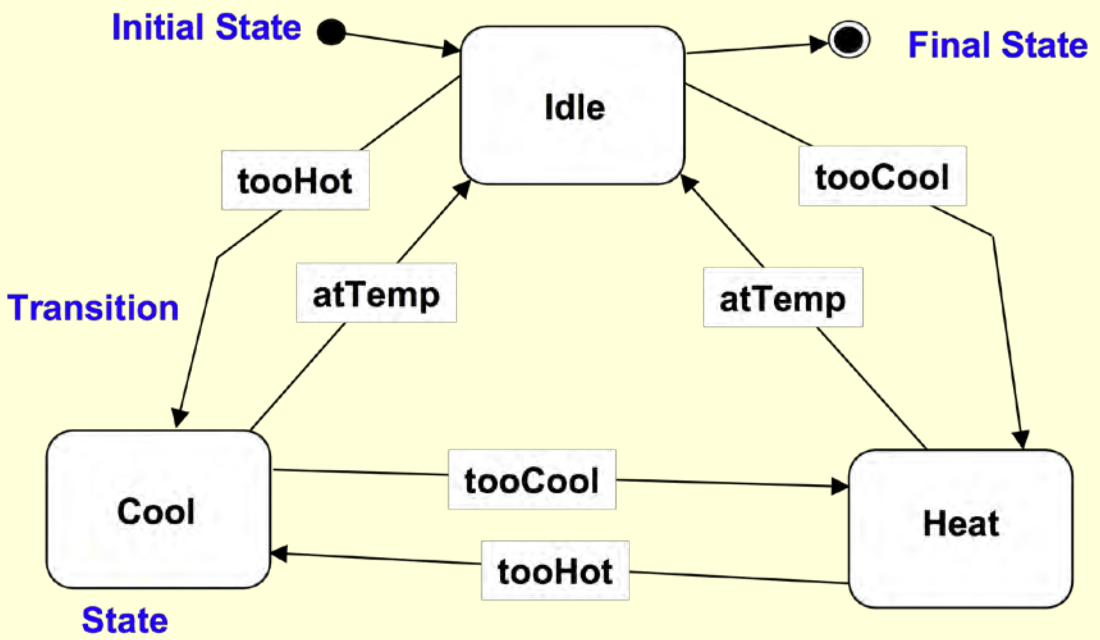
- Actually identical to sequence diagram content.
- Note used in SysML where it is replaced with block diagrams

Activity Diagram

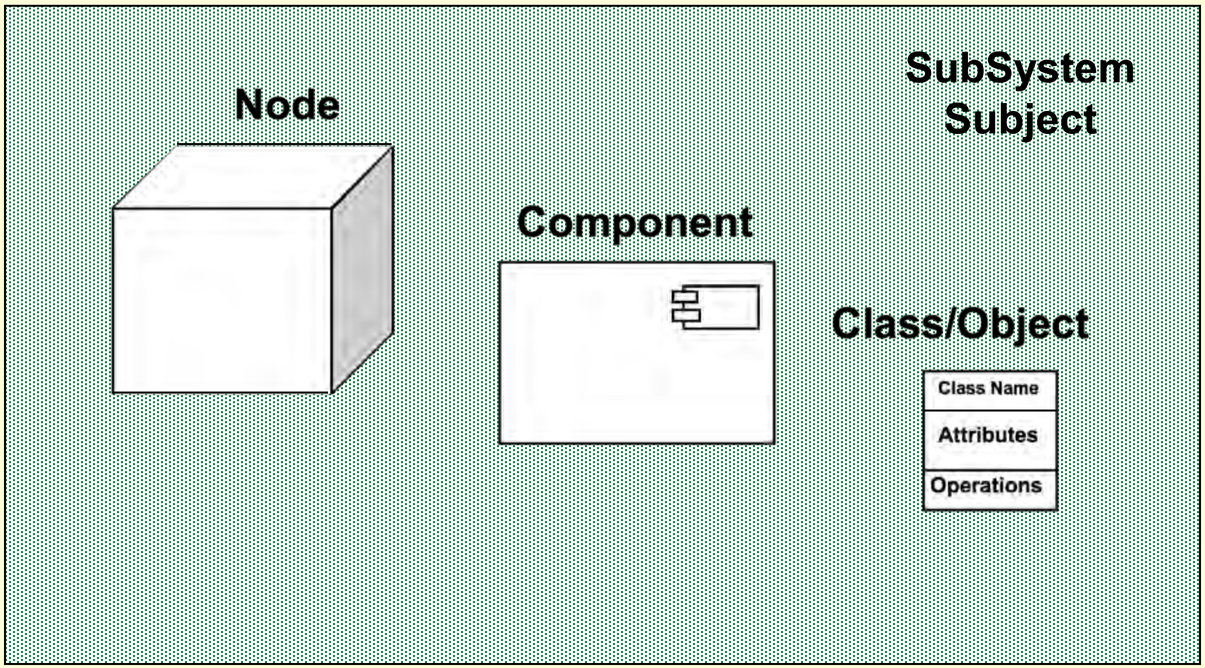
The old flow chart lives!



State Diagram
For a Bang-Bang Thermal Control System



UML Static Modeling Artifacts
Organization of the Design Solution

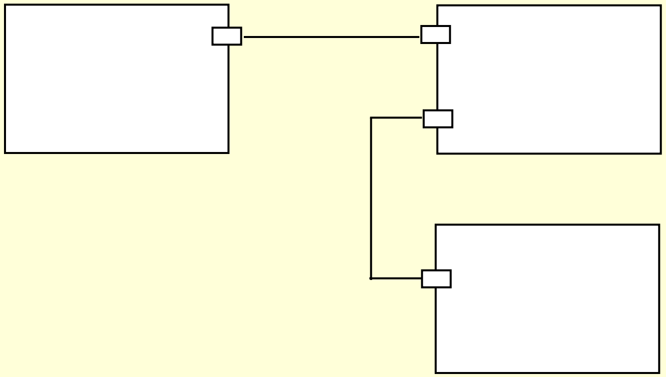


Replaced by block diagrams in SysML

SysML Blocks

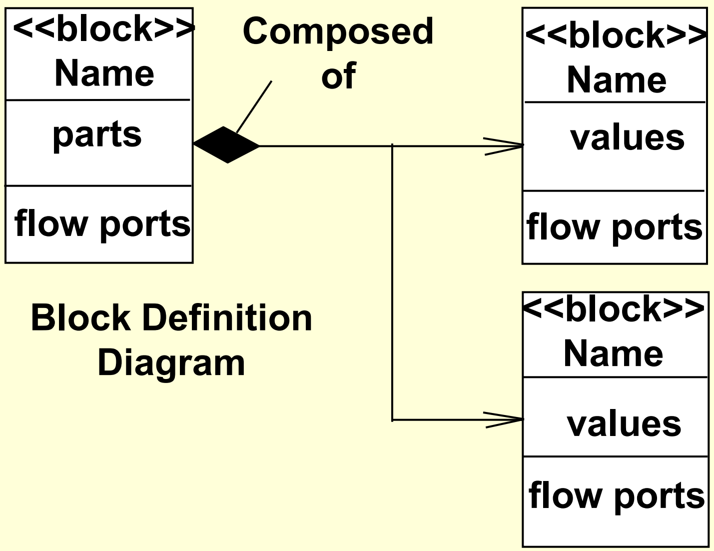
Static Elements of the System

- Internal Block Diagram
- Exposes the internal interactions inside of a block
- The interconnecting lines can represent relationships as diverse as the glue holding the wiper sensor to windshield or an interface command channel

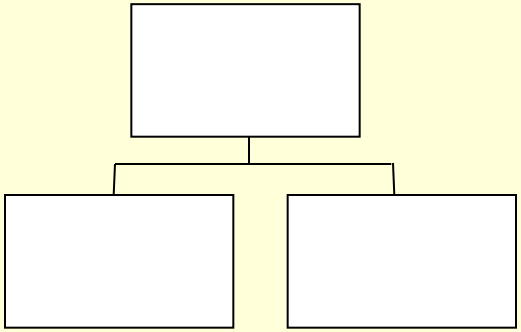


- Object, component, and node used in UML – why different?

SysML Blocks
Static Elements of the System

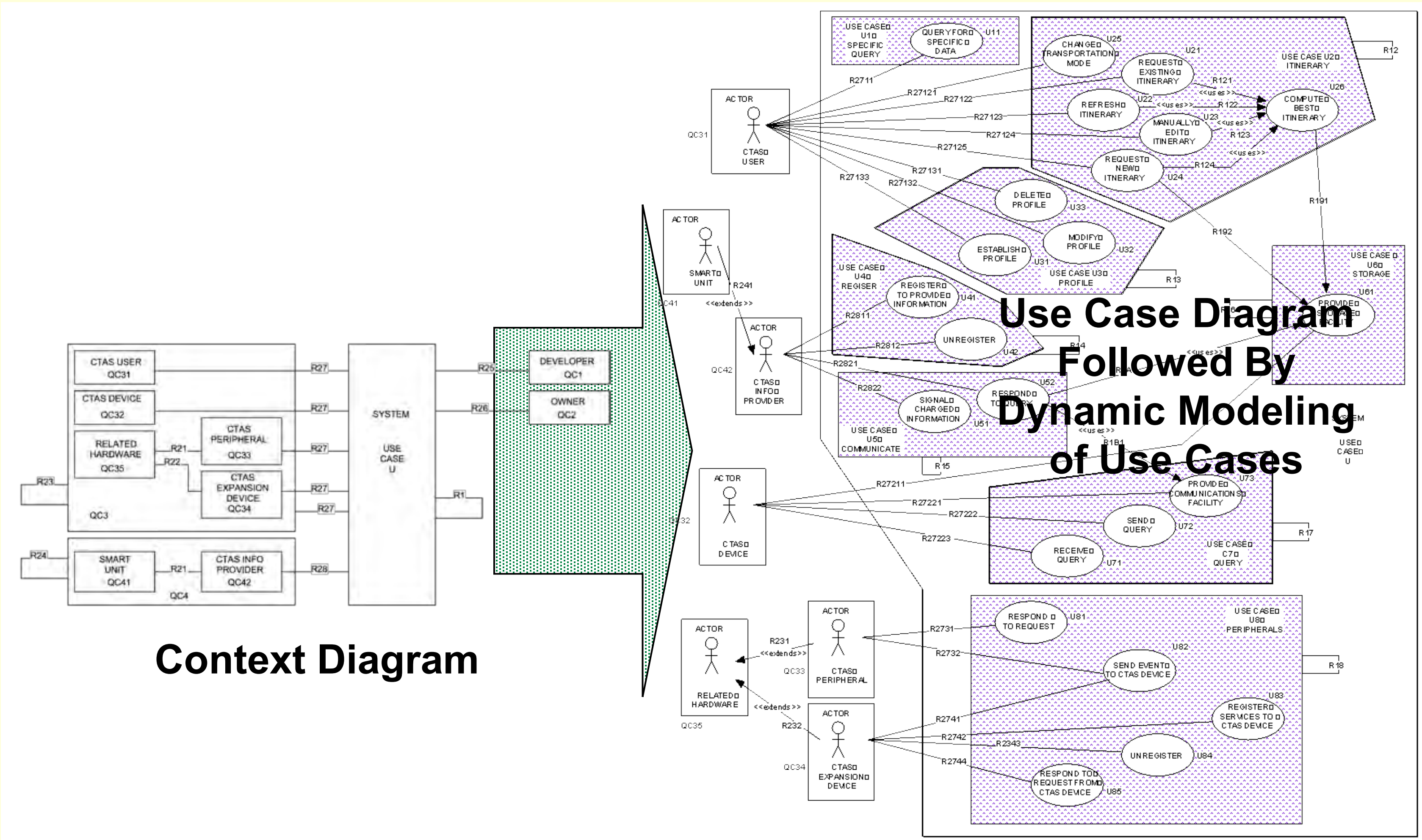


Block Definition Diagram



Equivalent Product Entity Block Diagram

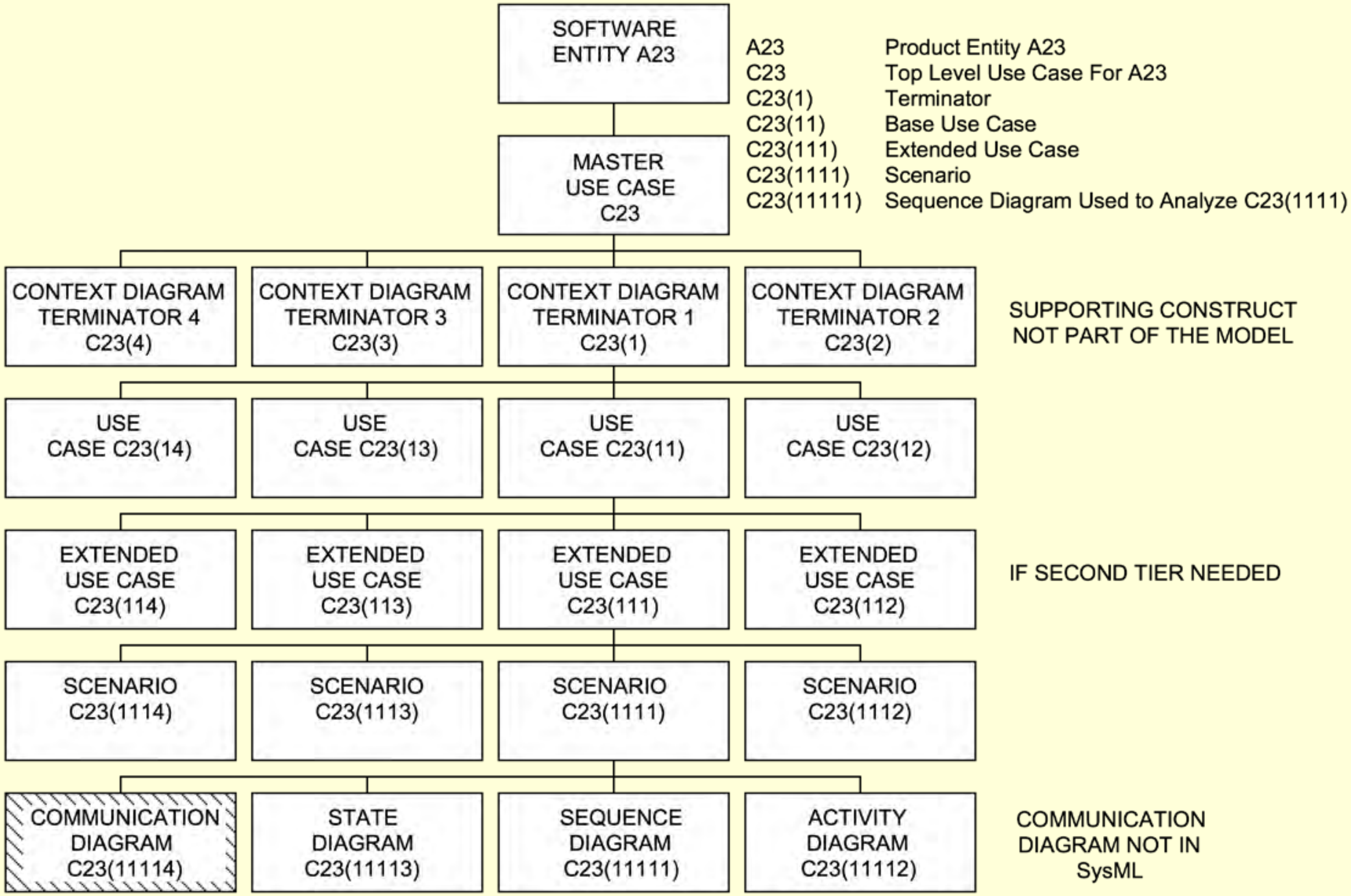
SysML/UML Modeling
Use Case Analysis Example



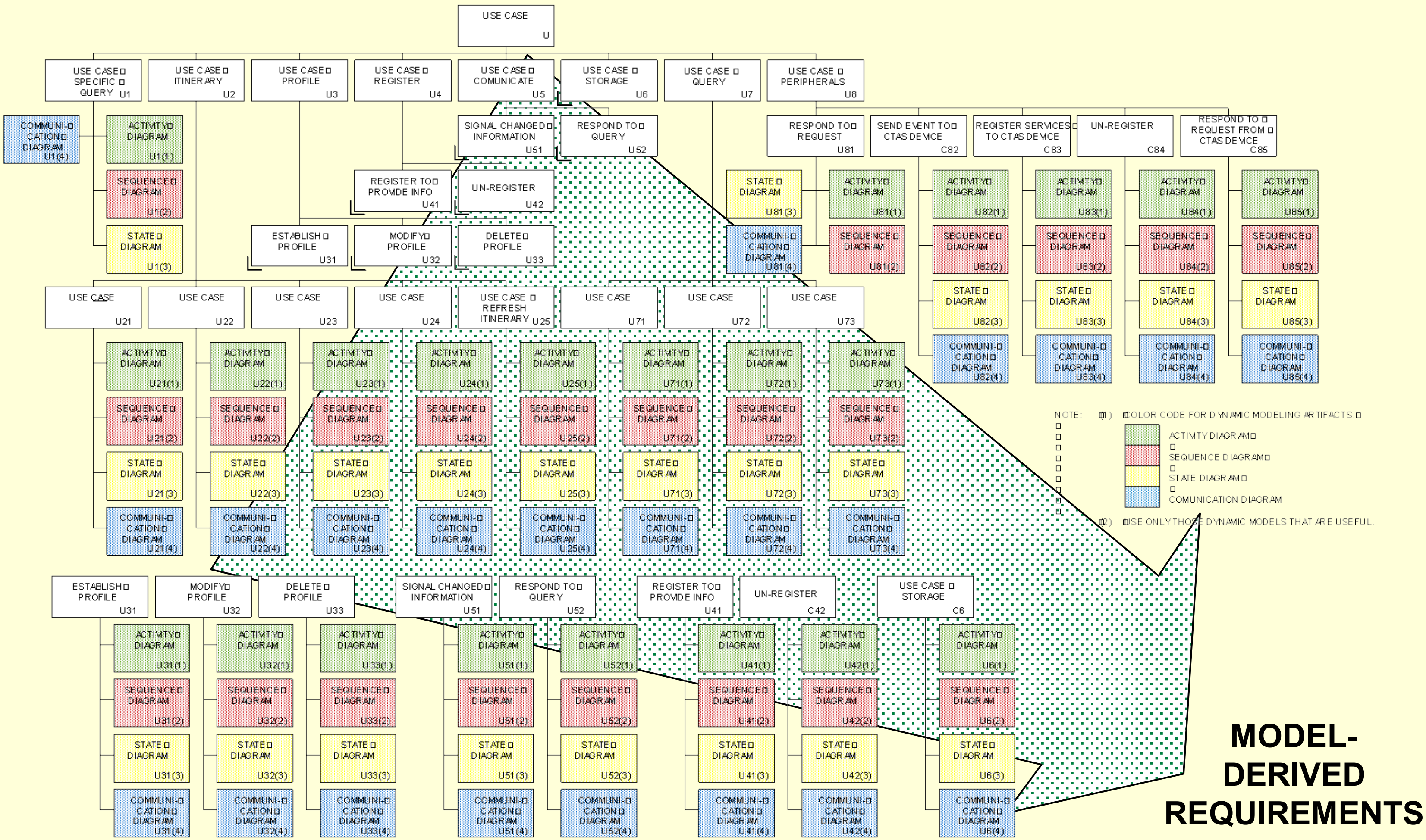
Context Diagram

Use Case Diagram Followed By Dynamic Modeling of Use Cases

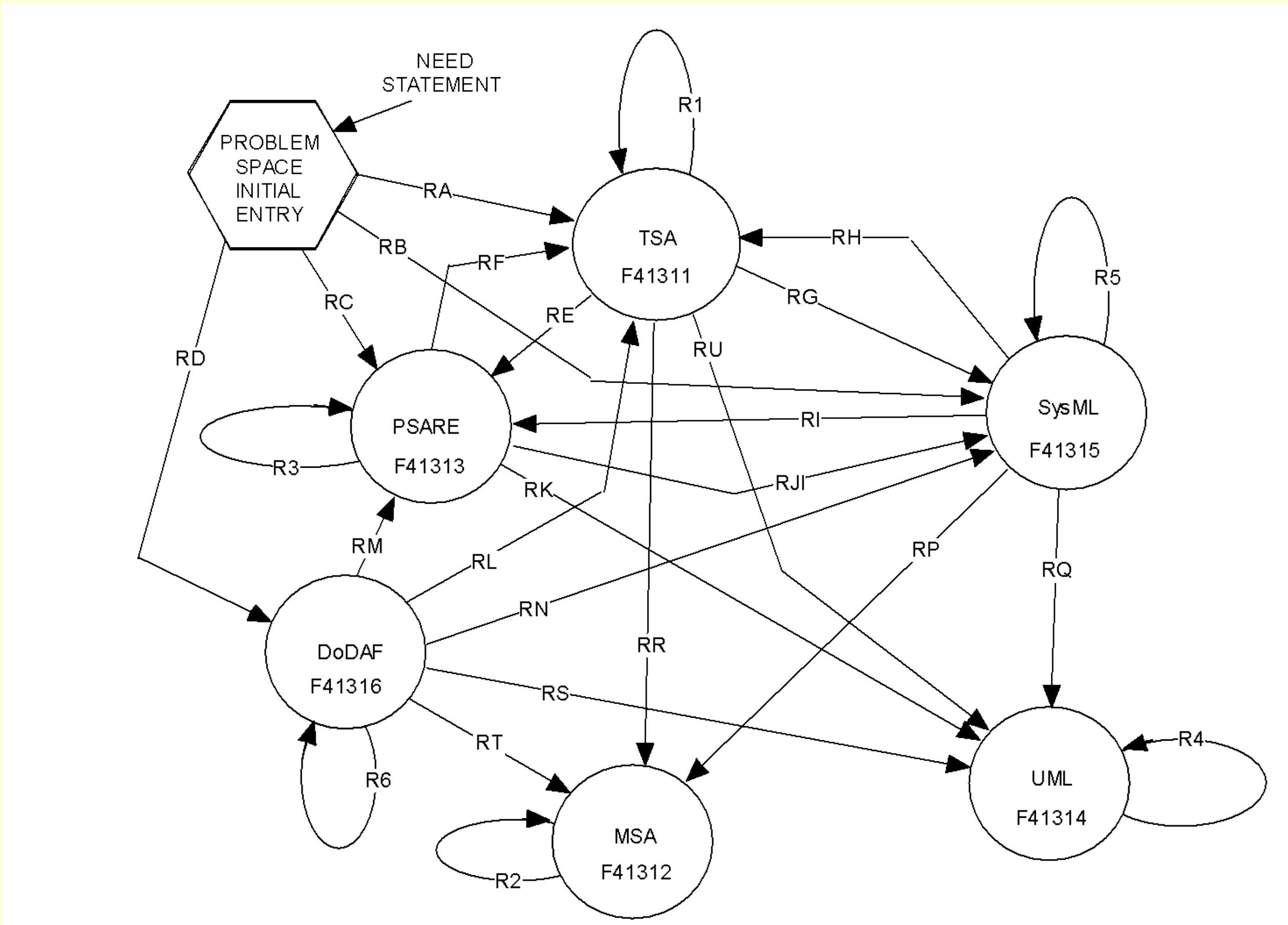
Hierarchical Structure for UML-SysML Analysis



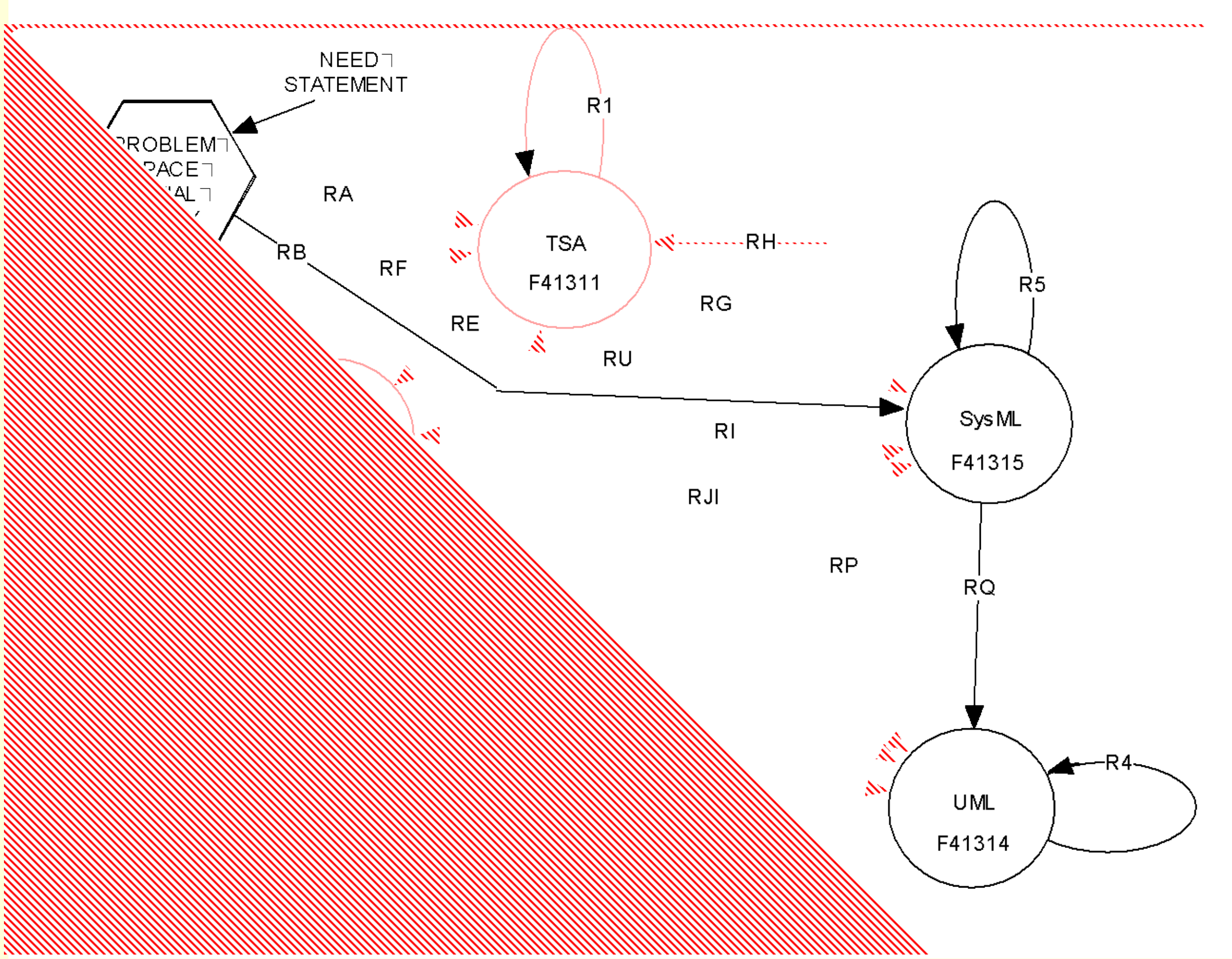
SysML/UML Modeling
Dynamic Modeling Artifacts Example



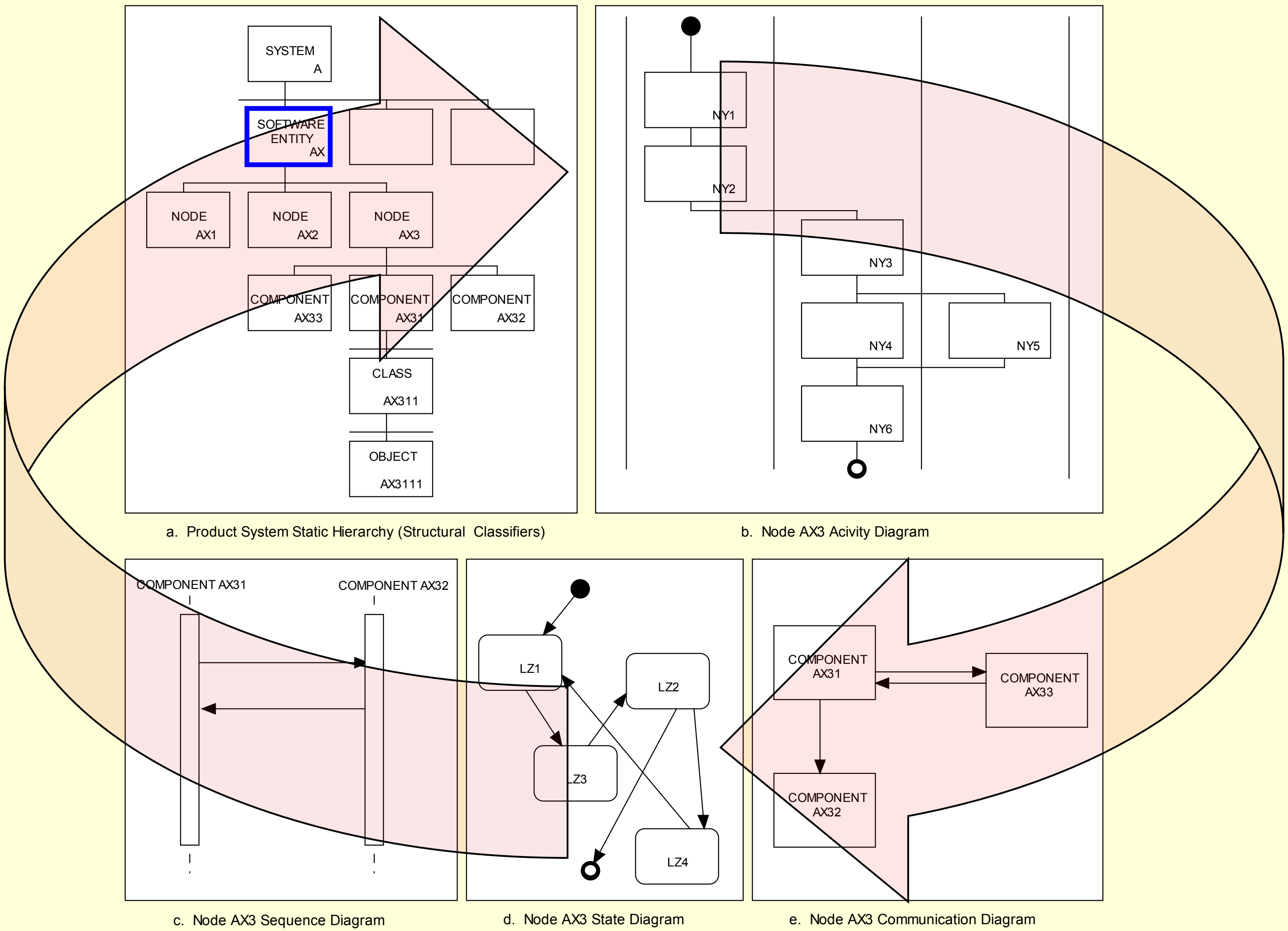
All Possible Inter-Model Transfers



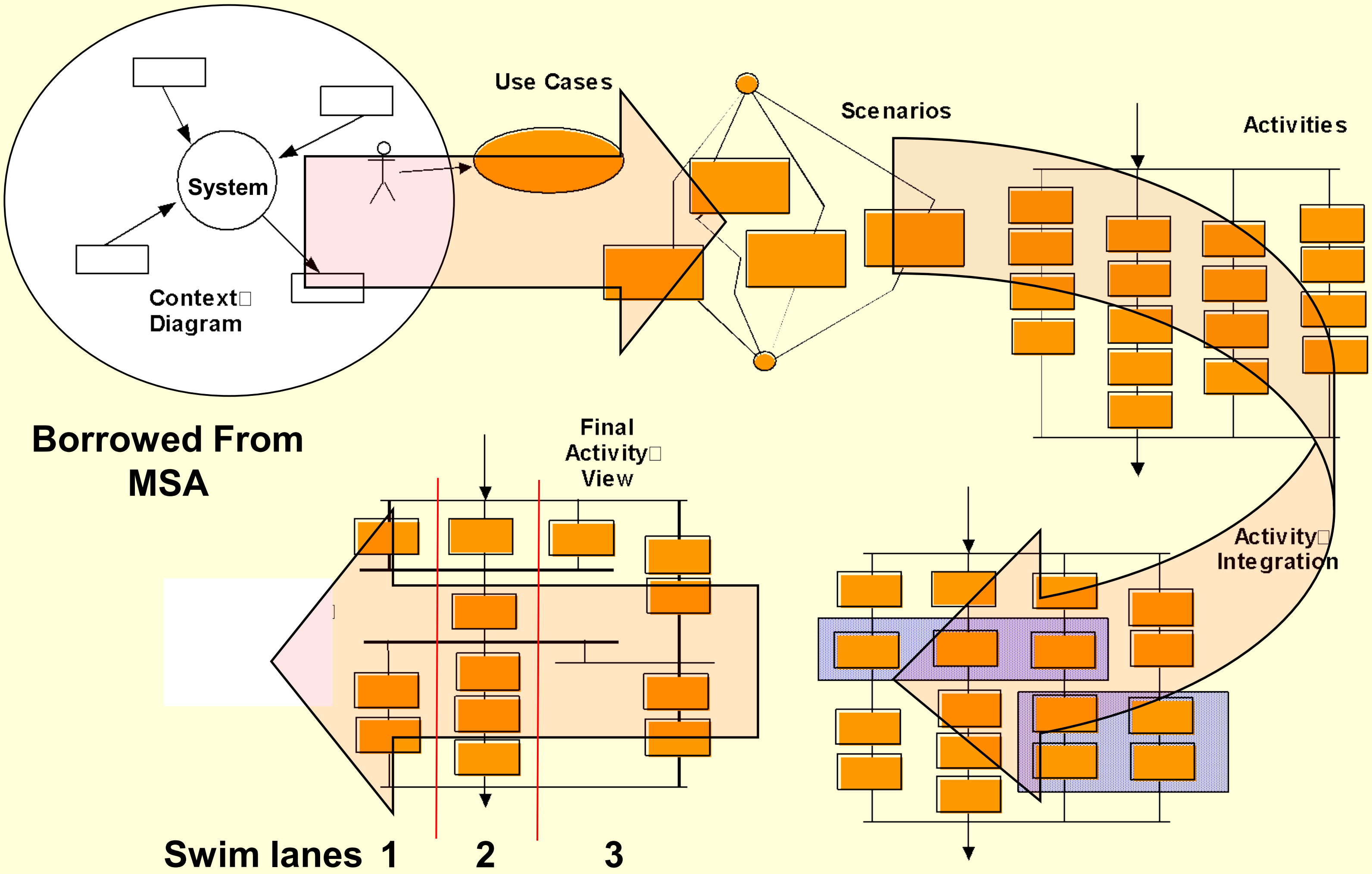
UADF Inter-Model Transfers With a SysML/UML UADF



UML- SysML Cyclical Analysis

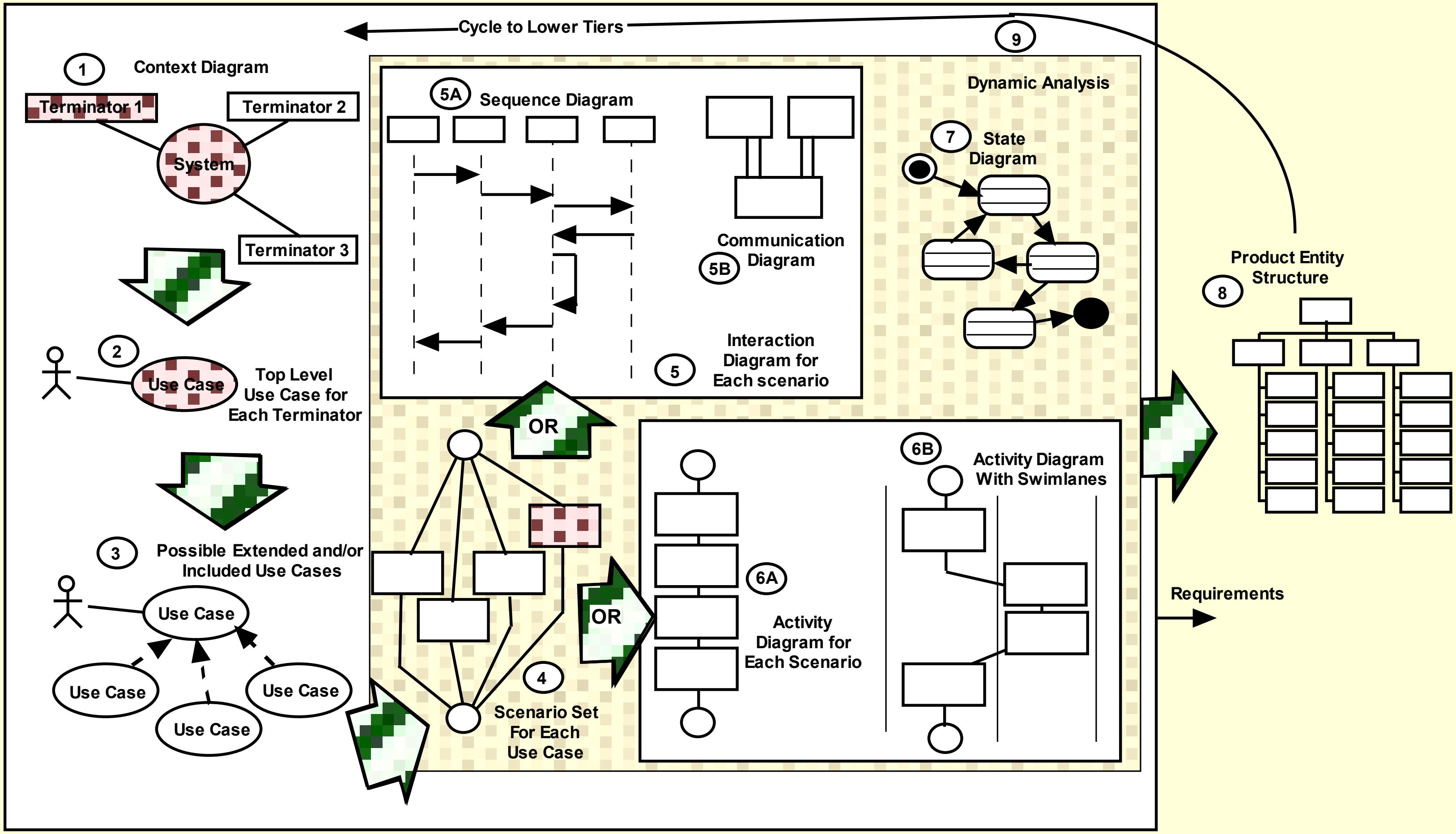


Entity Identification Using UML-SysML



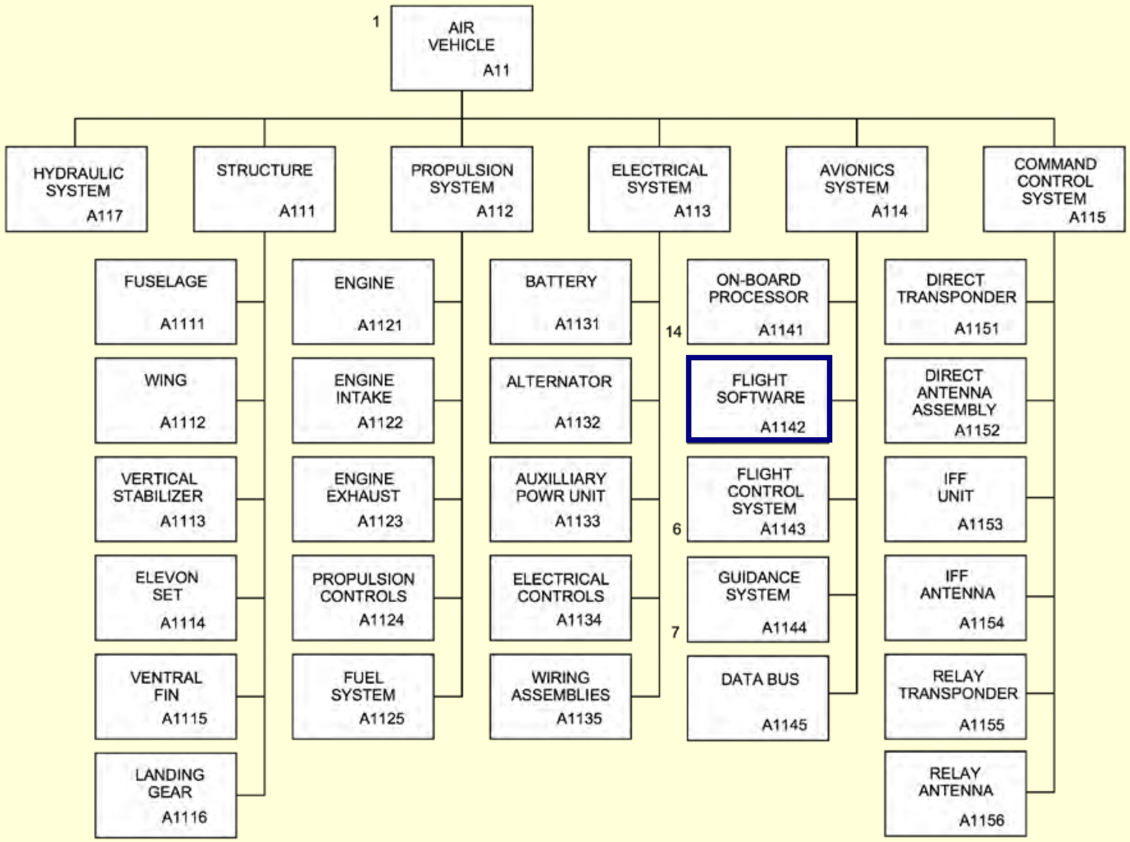
Borrowed From MSA

UML-SysML Dynamic Modeling Overview

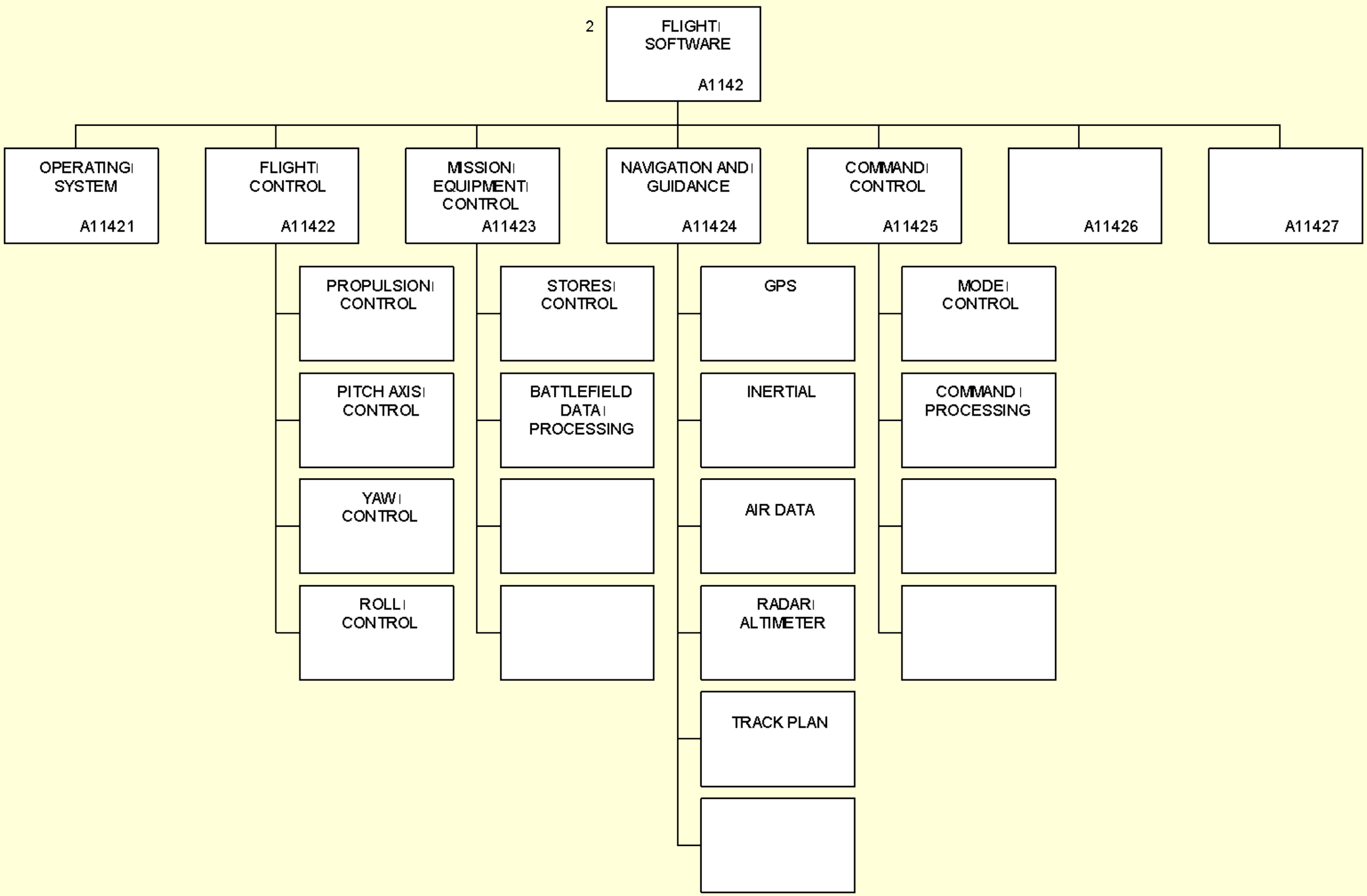


Combined Product Entity Structure

Entity identification flows from sequence, activity, or communication diagramming work

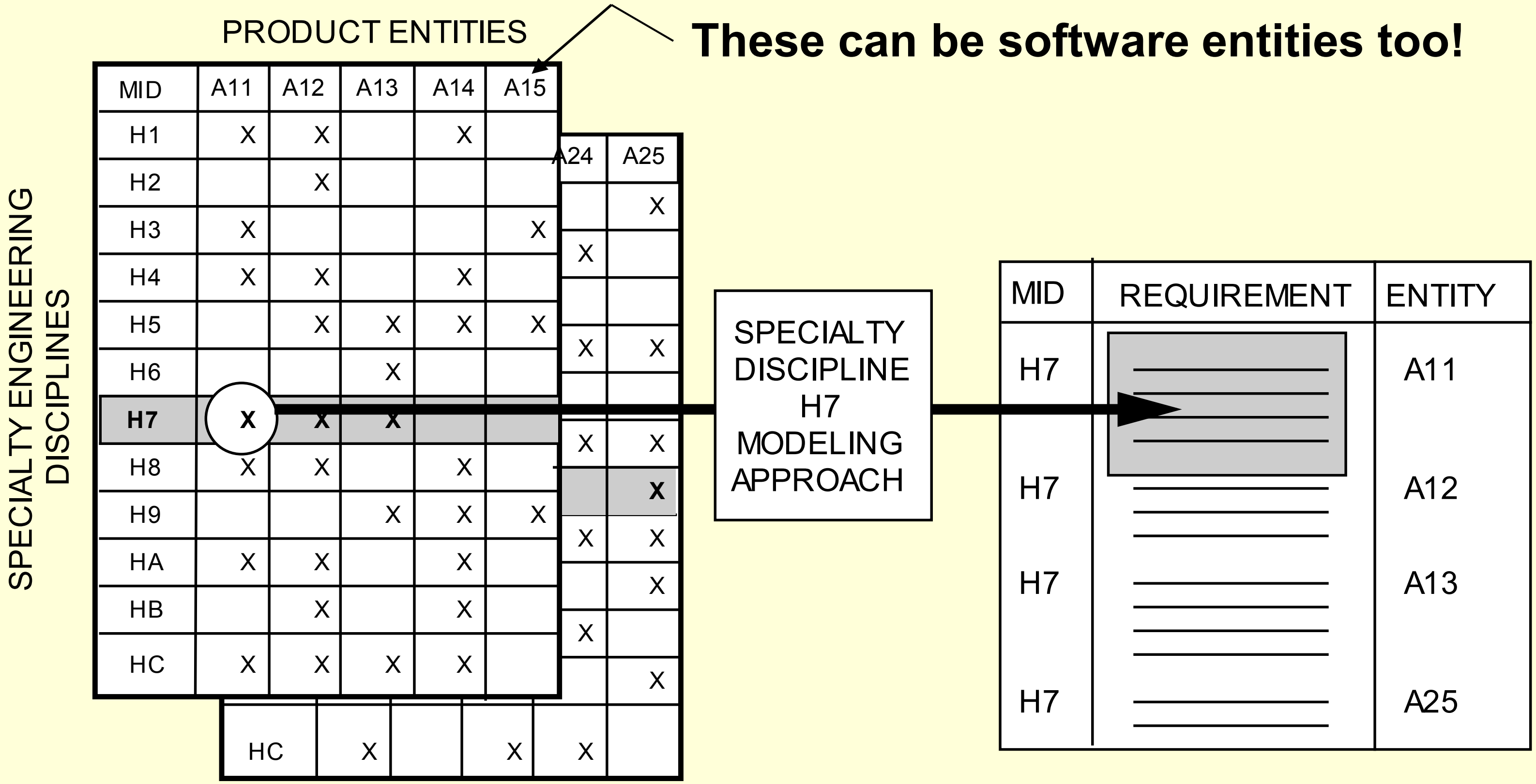


Possible Software Expansion



Specialty Engineering Modeling

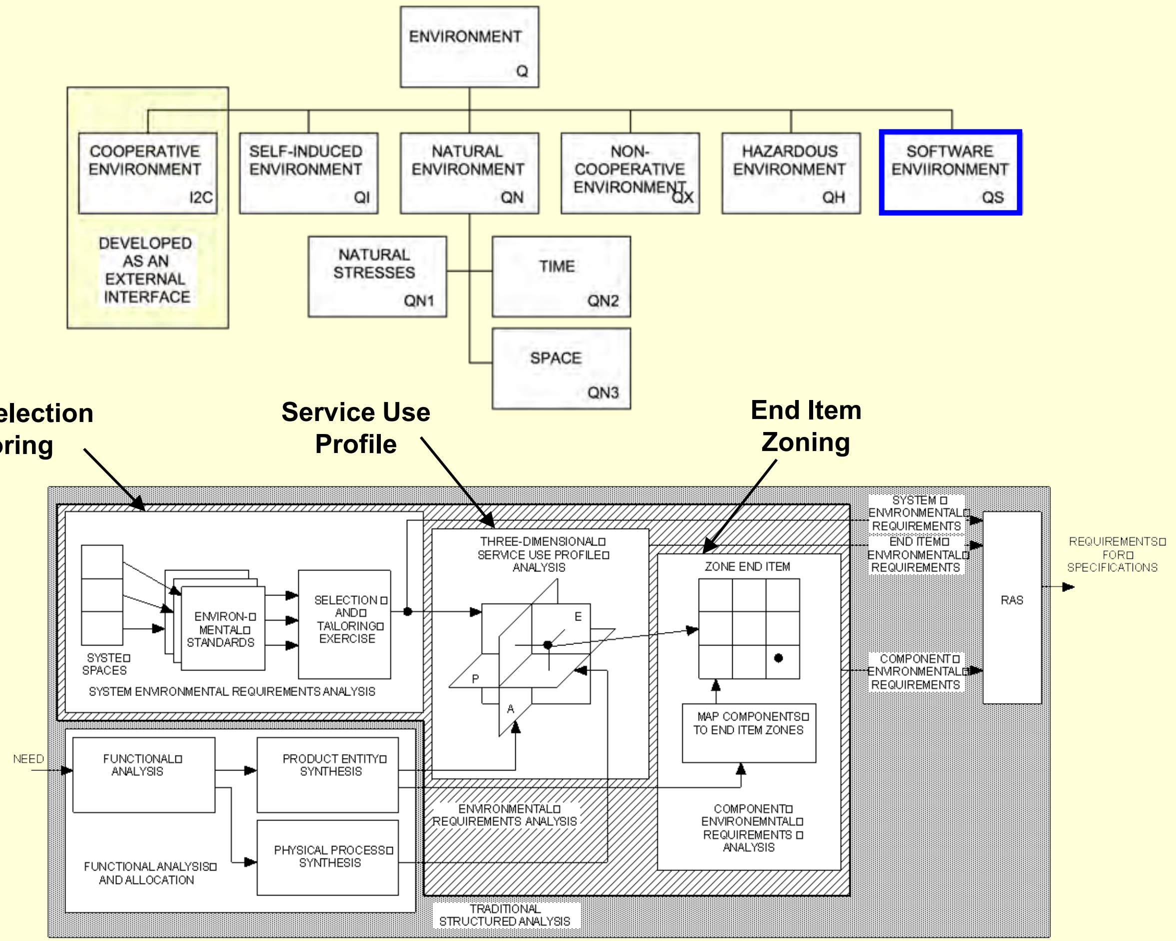
Once we know what the entities are we can investigate them from a specialty engineering perspective



a. Specialty Engineering Scoping Matrix

b. Requirements Analysis Sheet (RAS)

Environmental Modeling



Computer Software Environmental Factors

- Language
- Compiler
- Machine Structure
- Memory
- Clock Speed

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UNIVERSAL ARCHITECTURE DESCRIPTION FRAMEWORK

THE FUTURE

What Will the Future Look Like?

- A single model for the problem space - no matter the specific product - will be developed in hardware or software
- Requirements embedded in problem space models encouraging requirements compliance in design models with the specifications appearing in the form of models
- A connected series of models for design
- Inter-model effects observable directly rather than individual human interpretation of effects followed by conversation and action - can we do this?
- Verification linkage through models
- Eventual connection between the problem space modeling and CAD-CAM models.
- A business process model coordinated with engineering modeling

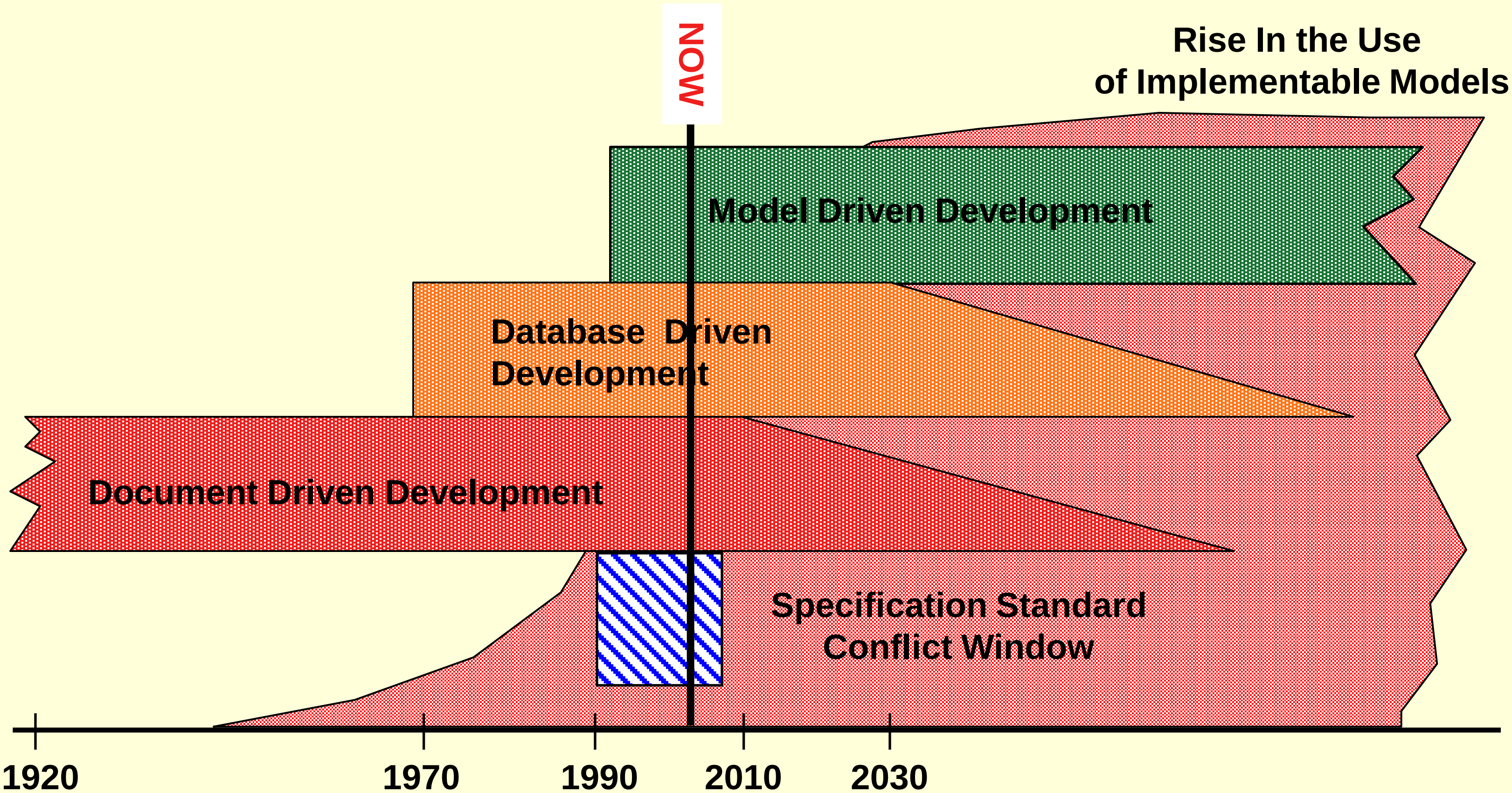
Model-Driven Challenges

- Will it be possible for managers to avoid whiplash due to the speed of the analytical process?
- Can we provide adequate exposure of the on-going and dynamic modeling work to encourage sound management of the development process?
- Will it really be possible to build models that fully express the problem space essential characteristics (requirements) while permitting a solution space larger than a single solution?

The Computer Network Becomes a Team Member in Good Standing

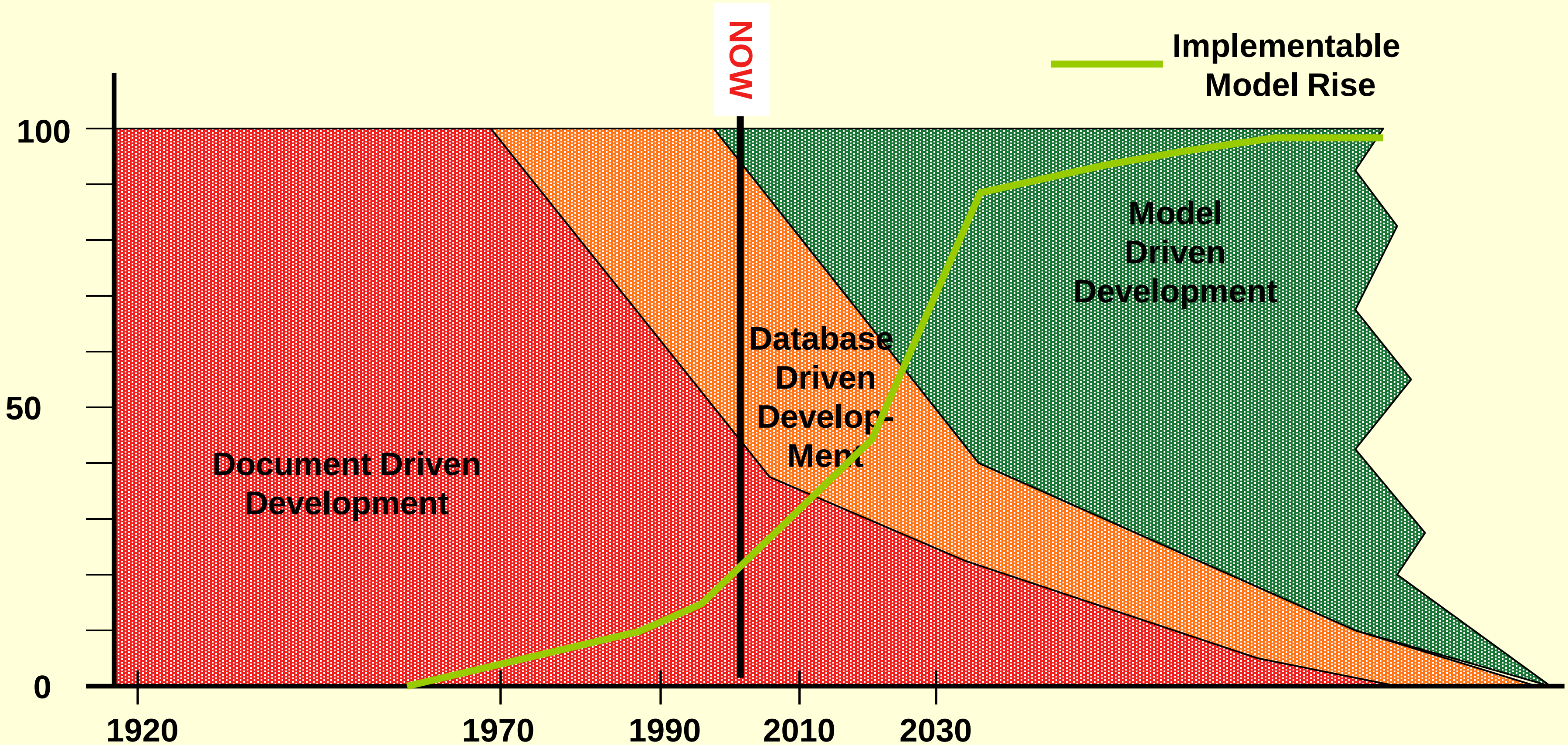
Will there be room for human emotion in the development process? I hope so!

Development Evolution Timeline, Driving Methods Staging



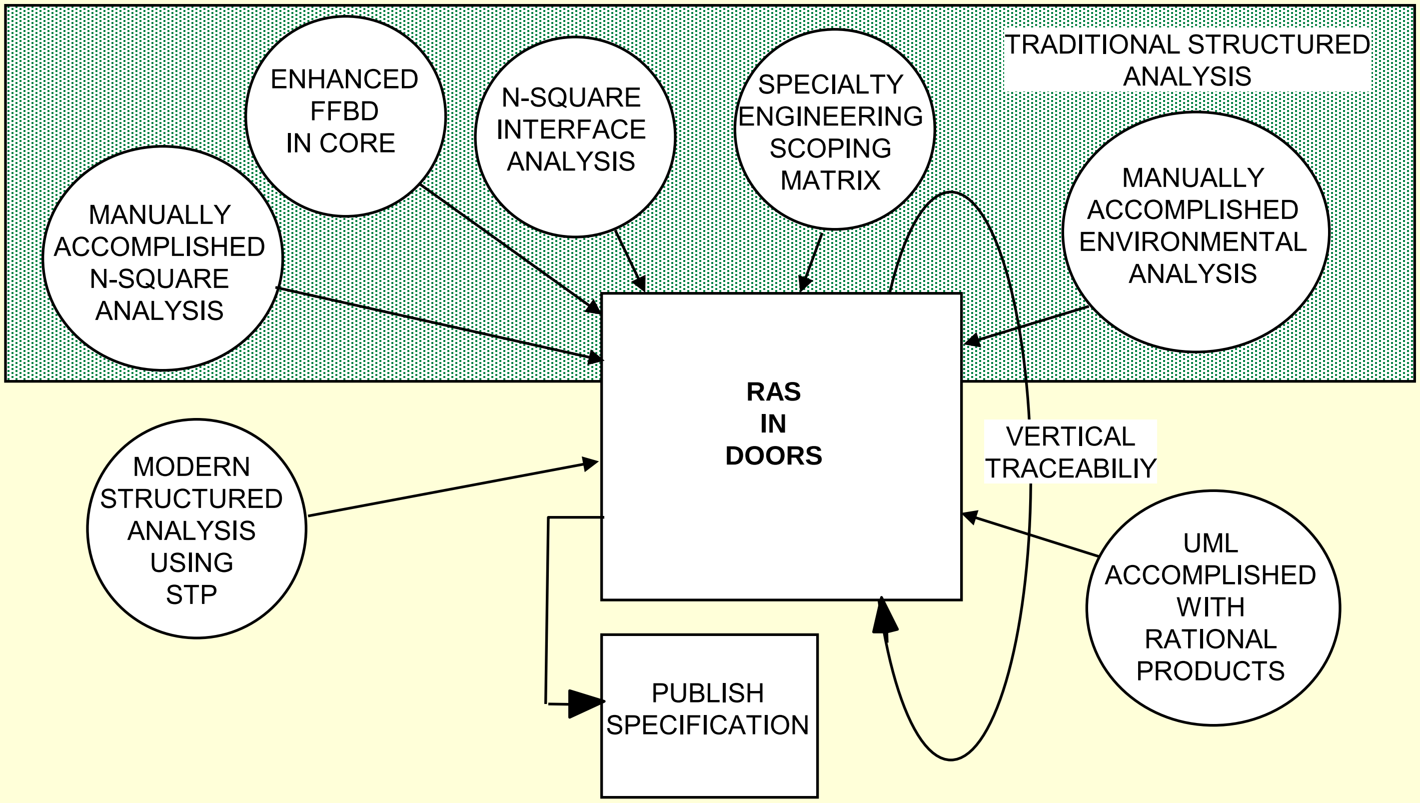
05-15-2002 DATA UNSUBSTANTIATED

Development Evolution Timeline, Program Percentages?

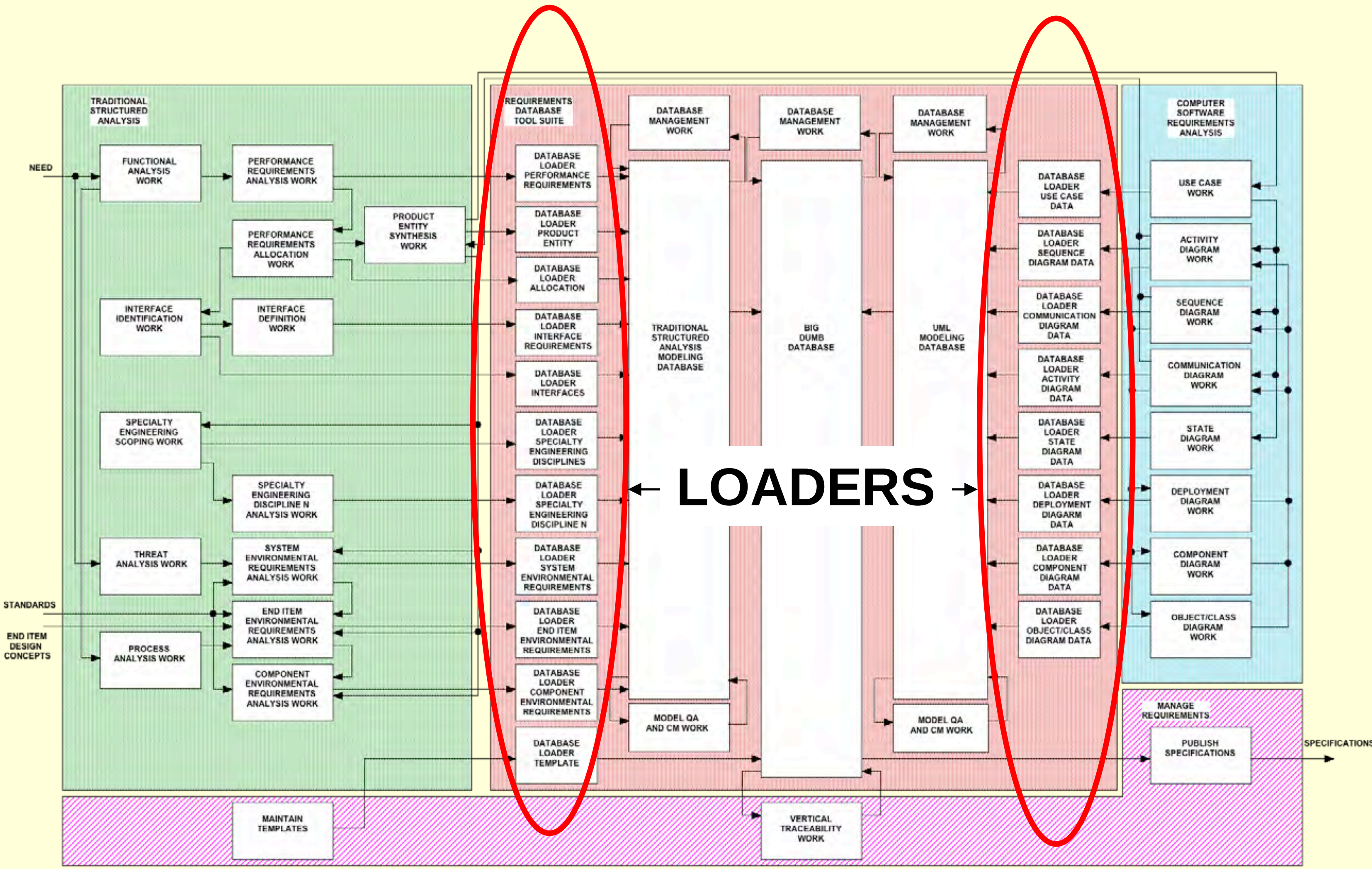


05-15-2002 DATA UNSUBSTANTIATED

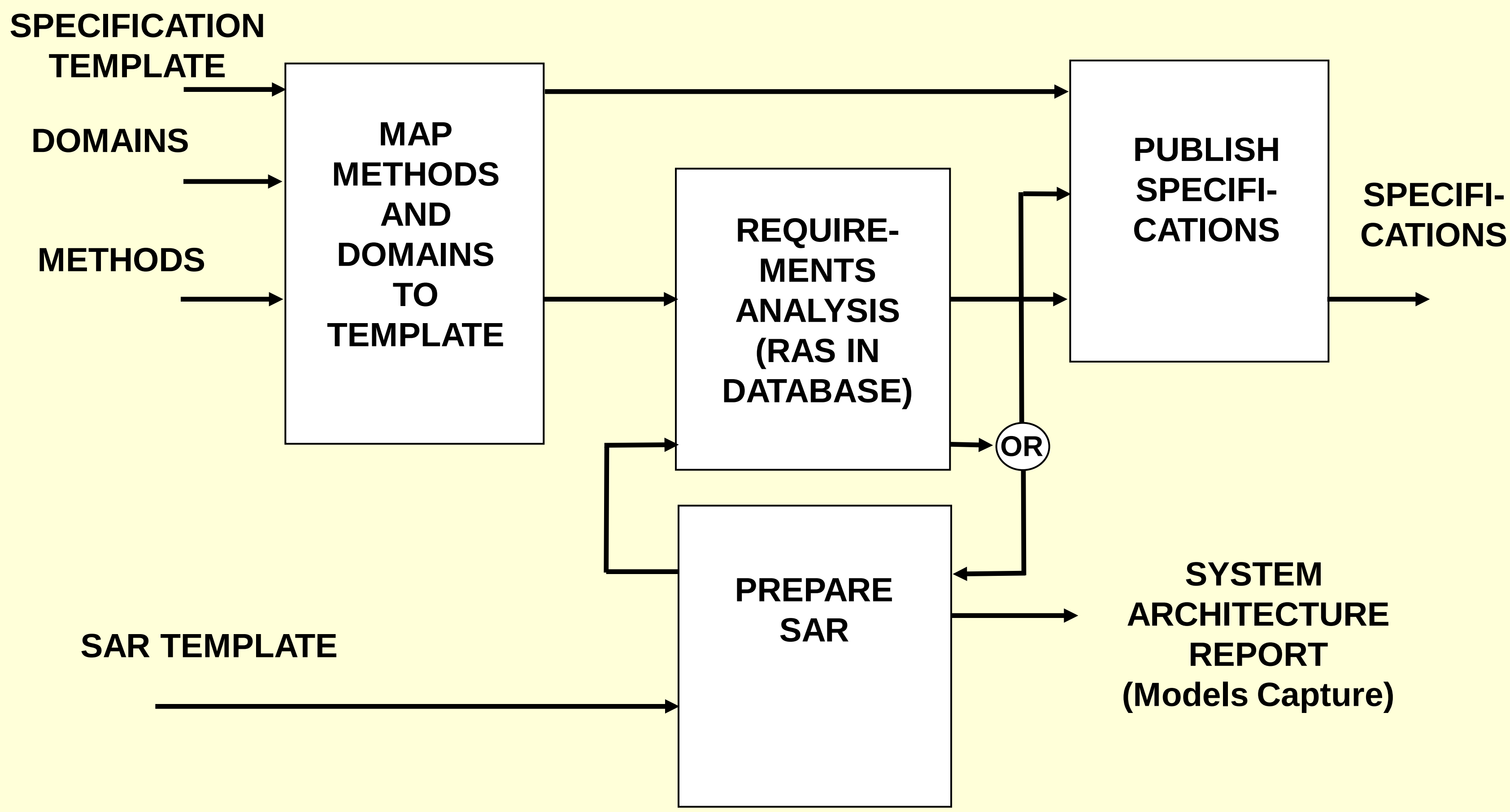
Our Current Best Toolbox?



Possible Interim Tools Suite



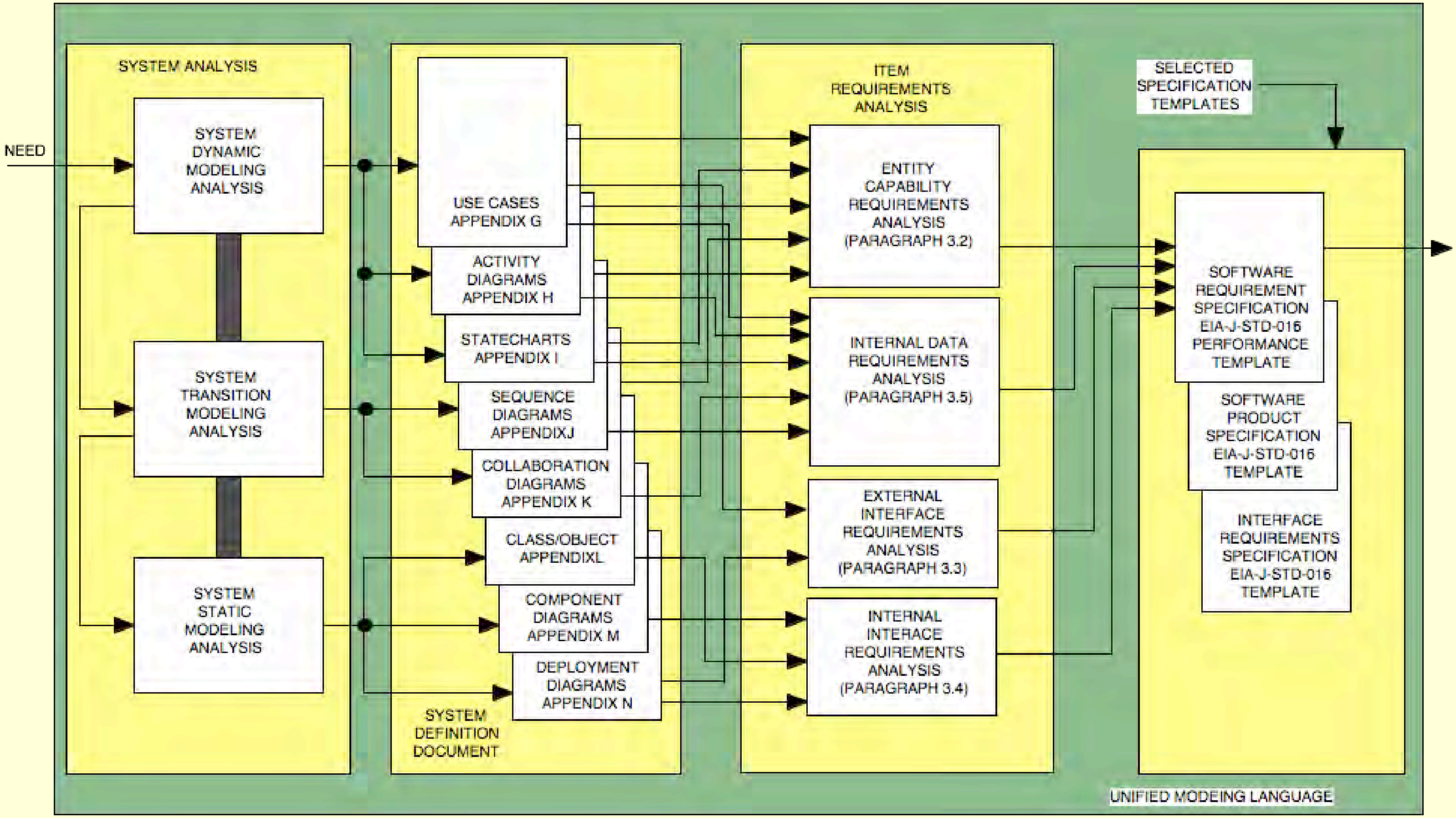
Specification Generator
The Same Machinery Used for TSA



Three Ways to Capture the Modeling

- Within specification paragraph 3.1.3
- In a system architecture report (SAR) referenced in paragraph 3.1.3
- Within the computer tool used to accomplish the modeling work with a reference in paragraph 3.1.3 to the tool content

SAR Organization For UML-SysML



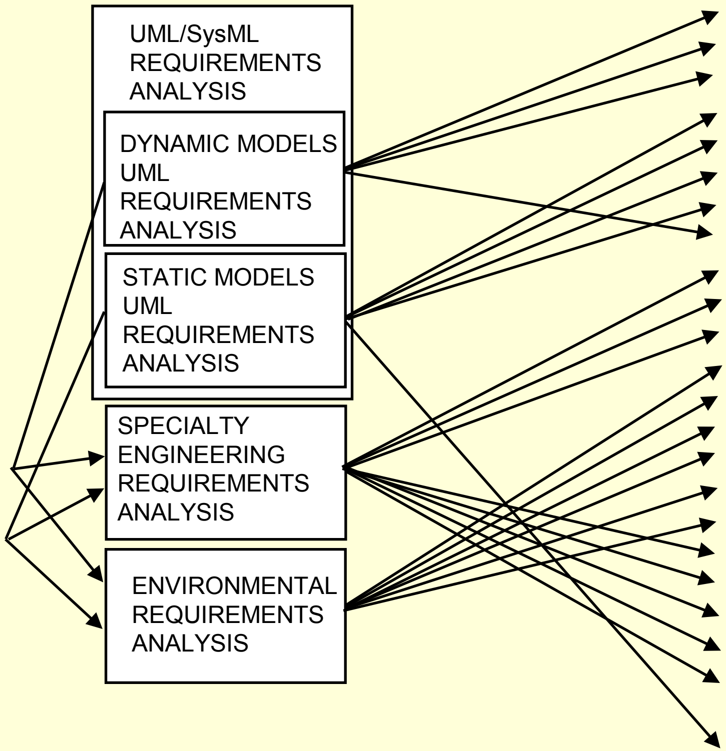
Combined RAS

We need a set of MID codes that we can use to couple modeling structures to requirements derived from them.

MODEL ENTITY		REQUIREMENT ENTITY		PRODUCT ENTITY		DOCUMENT ENTITY	
MID	MODEL ENTITY NAME	RID	REQUIREMENT	PID	ITEM NAME	PARA	TITLE
F47	Use System			A	Product System		
F471	Deployment Ship Operations			A	Product System		
F4711	Store Array Operationally	XR67	Storage Volume < 10 ISO Vans	A1	Sensor Subsystem		
H	Specialty Engineering Disciplines			A	Product System		
H11	Reliability	EW34	Failure Rate < 10 x 10-6	A1	Sensor Subsystem	3.1.5	Reliability
H11	Reliability	RG31	Failure Rate < 3 x 10-6	A11	Cable	3.1.5	Reliability
H11	Reliability	FYH4	Failure Rate < 5 x 10-6	A12	Sensor Element	3.1.5	Reliability
H11	Reliability	G8R4	Failure Rate < 2 x 10-6	A13	Pressure Vessel	3.1.5	Reliability
H12	Maintainability	6GHU	Mean Time to Repair < 0.2 Hours	A1	Sensor Subsystem	3.1.6	Maintainability
H12	Maintainability	U9R4	Mean Time to Repair < 0.4 Hours	A11	Cable	3.1.6	Maintainability
H12	Maintainability	J897	Mean Time to Repair < 0.2 Hours	A12	Sensor Element	3.1.6	Maintainability
H12	Maintainability	9D7H	Mean Time to Repair < 0.1 Hours	A13	Pressure Vessel	3.1.6	Maintainability
I	System Interface			A	Product System		
I1	Internal Interface			A	Product System		
I11	Sensor Subsystem Innerface			A1			
I181	Aggregate Signal Feed Source Impedance	E37H	Aggregate Signal Feed Source Impedance= 52 ohms ± 2 ohms	A1	Sensor Subsystem		
I181	Aggregate Signal Feed Load Impedance	E37I	Aggregate Signal Feed Load Impedance= 52 ohms ± 2 ohms	A4	Analysis and Reporting Subsystem		
I2	System External Interface			A	Product System		
Q	System Environment			A	Product System		
QH	Hostile Environment			A	Product System		
QI	Self-Induced Environmental Stresses			A	Product System		
QN	Natural Environment			A	Product System		
QN1	Temperature	6D74	-40 degrees F< Temperature < +140 degrees F	A	Product System		
QX	Non-Cooperative Environmental Stresses			A	Product System		

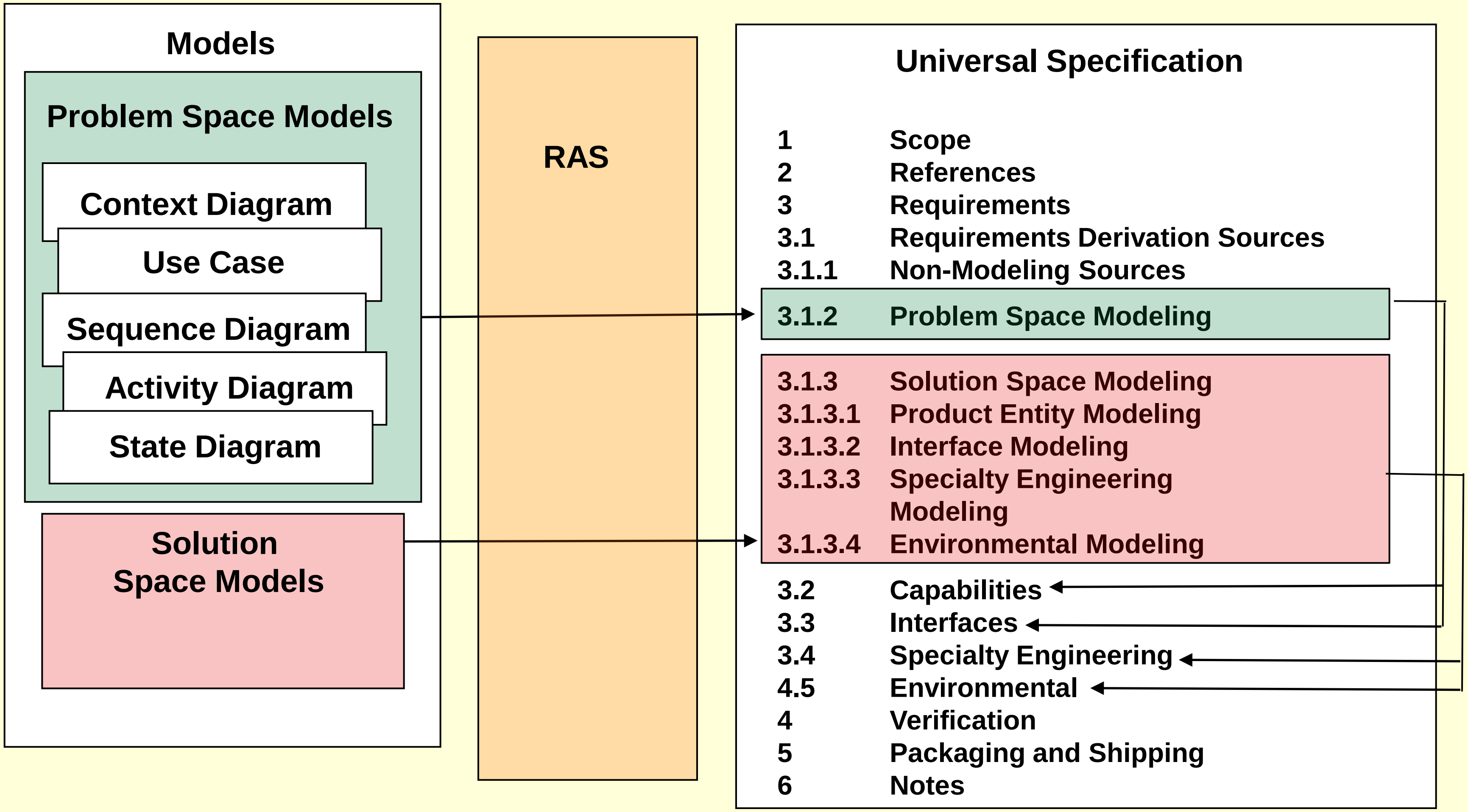
UML Model/SRS Template Correlation

If You Must Use MIL-STD-498/EIA J STD-016

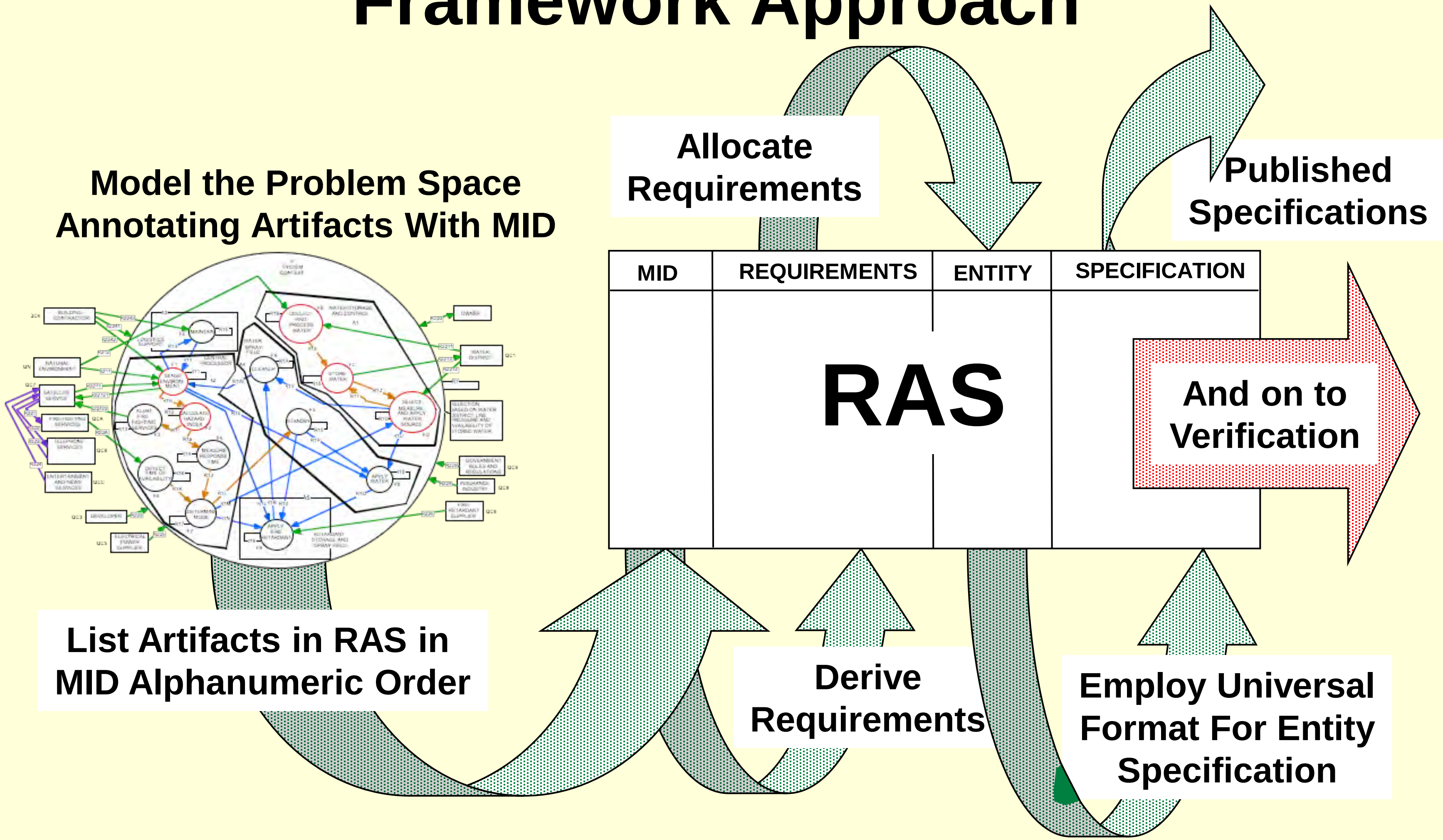


3	Requirements
3.1	Required States and Modes
3.2	CSCI Capability Requirements
3.2.x	(CSCI Capability)
3.3	CSCI External Interface Requirements
3.3.1	Interface Identification and Diagram
3.3.x	(Project Unique Interface Identifier)
3.4	CSCI Internal Interface Requirements
3.5	CSCI Internal Data Requirements
3.6	Adaptation Requirements
3.7	Safety Requirements
3.8	Security and Privacy Requirements
3.9	CSCI Environment Requirements
3.10	Computer Resource Requirements
3.10.1	Computer Hardware Requirements
3.10.2	Computer Hardware Resource Utilization Requirements
3.10.3	Computer Software Requirements
3.10.4	Computer Communications Requirements
3.11	Software Quality Factors
3.12	Design and Implementation Constraints
3.13	Personnel-Related Requirements
3.14	Training-Related Requirements
3.15	Logistics-Related Requirements
3.16	Other Requirements
3.17	Packaging Requirements
3.18	Precedence and Criticality of Requirements

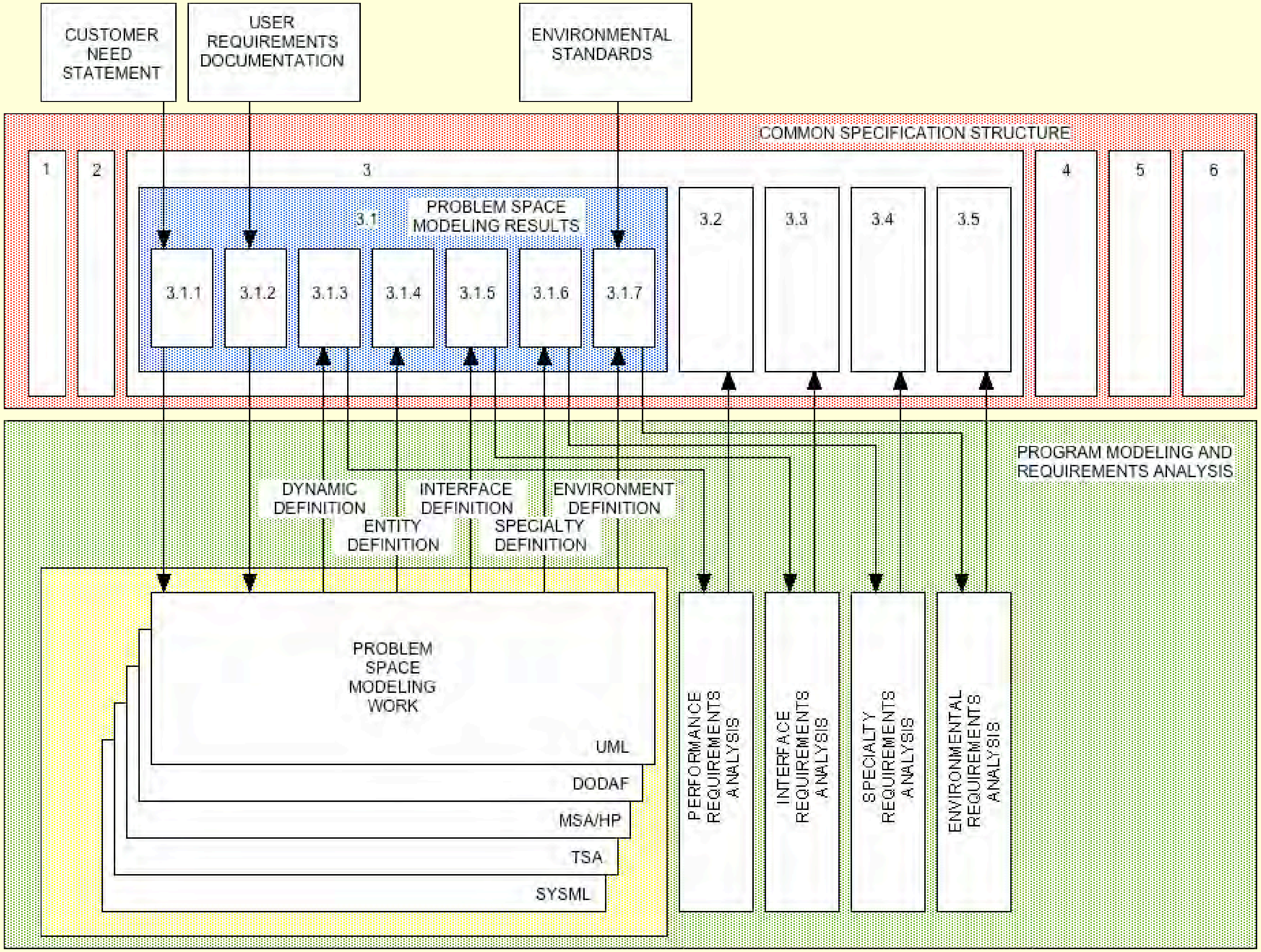
Model Results Flow Into Specifications Content Through the RAS



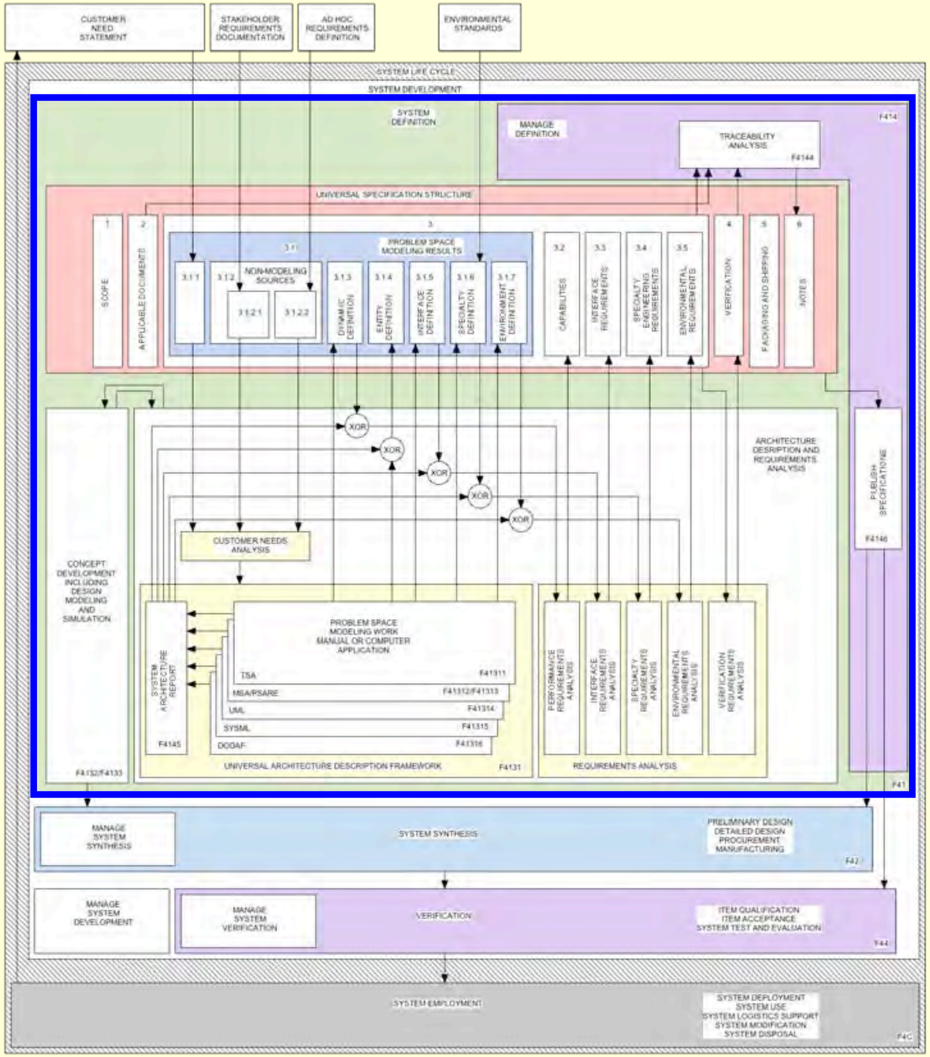
Universal Architecture Description Framework Approach



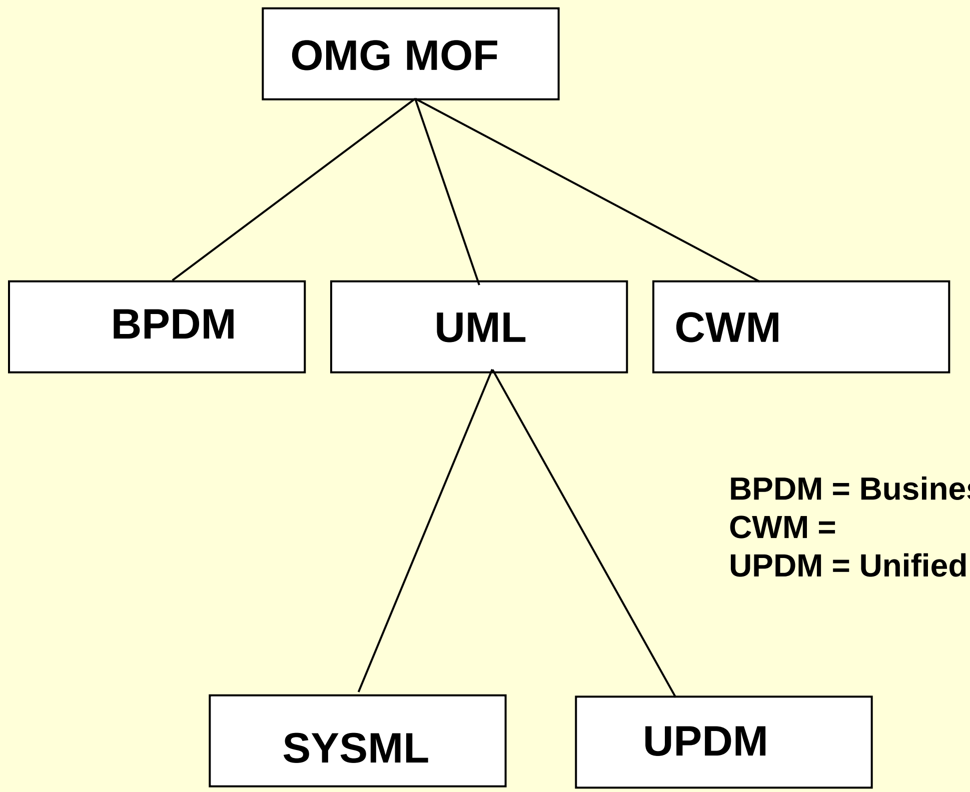
Building Universal Specifications



It Fits Into a Grander Structure



Model Convergence On the Road to Enterprise Architecting



BPDM = Business Process Data Model
CWM =
UPDM = Unified Profile For DODAF MoDAF

Action Items For You as a System Engineer

- Continue your studies of requirements work
- Come to an understanding about UML and SysML
- Within your companies and programs develop modeling skills and work toward simplifying your combined set of models into a universal framework
- Work toward correlating the SW and HW development work patterns so as to encourage more effective integration
- Join INCOSE/NDIA working groups that deal with the issues covered in this tutorial and offer your ideas.

Tasks For a Development Organization

- Select a set of models for your UADF
- Train your people to apply those models to problem space
- Perfect inter-model traceability and integration skills as well as coordination of modeling and concept development work
- Insist on requirements being derived from models
- Apply a universal specification format
- Capture the work products that result from modeling work in a configuration manageable form
- Get on the tools treadmill

The Seven Fundamentals of Mentoring

Nicholas M. Torelli

Systems Engineering Directorate
Office of the Director, Defense Research and Engineering

13th Annual NDIA Systems Engineering Conference
October 25, 2010

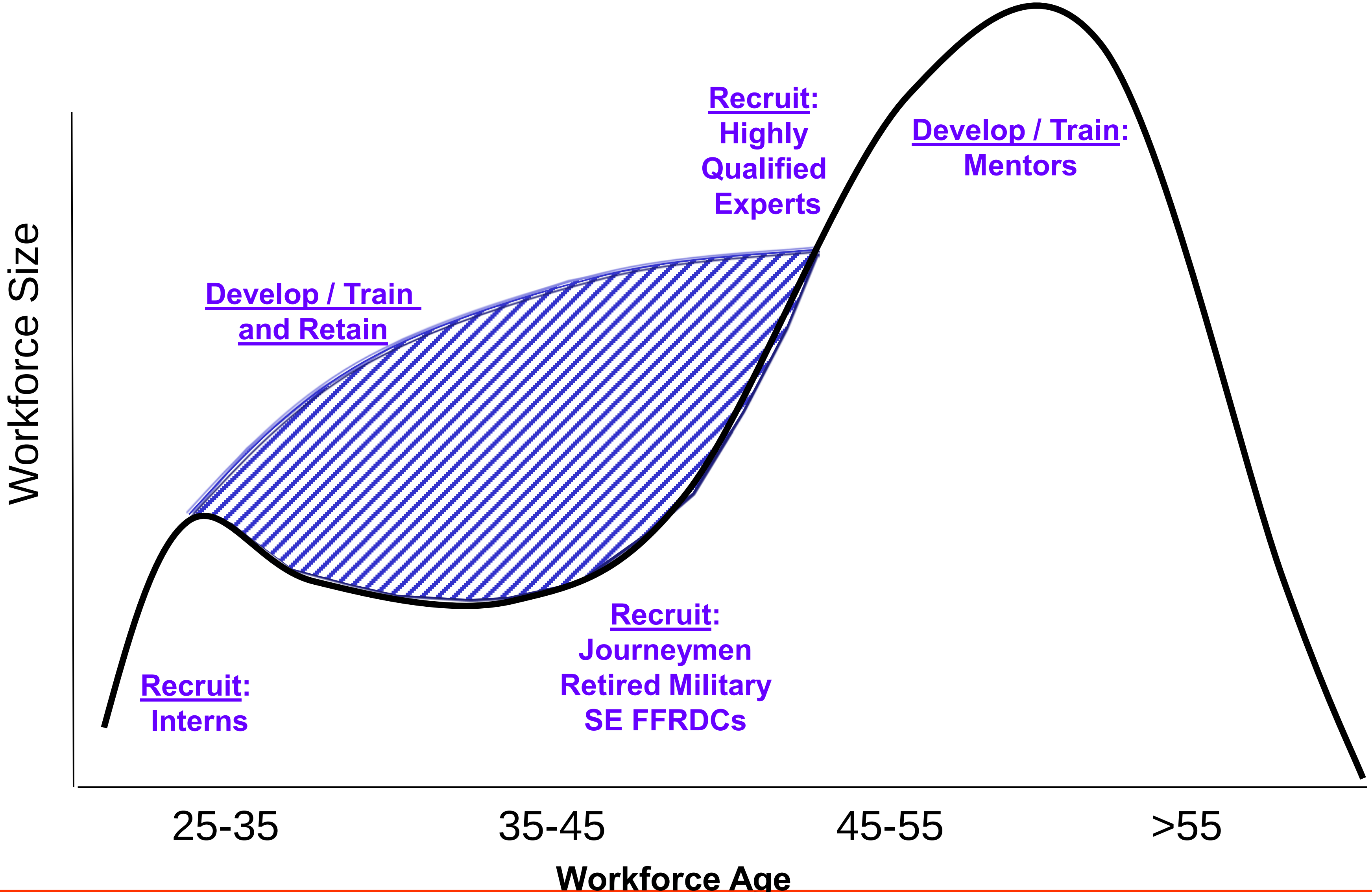
Mentoring Workshop Overview

Part I: Background
- Definition and Background
- Why We Need It
- Successful Mentoring
- Characteristics of a Good Mentor
- Benefits of Mentoring
- Protégés
- Mentoring Models
- Mentoring Relationships
- Tips for Mentoring

Break

Part II: Seven Fundamentals of Mentoring
- Mentoring Takes Place Outside of a Manager-Employee Relationship
- Mentoring is Career Focused
- Mentoring Relationships are Personal and Confidential
- Mentoring Relationships Cross Job Boundaries
- Mentoring Identifies Unique Skills and Abilities
- Mentoring Provides Insight Into the Workings of the Organization
- Mentoring Communicates Organizational and Professional Values
- Poor Mentoring Practices
- Summary

DoD Systems Engineering Workforce



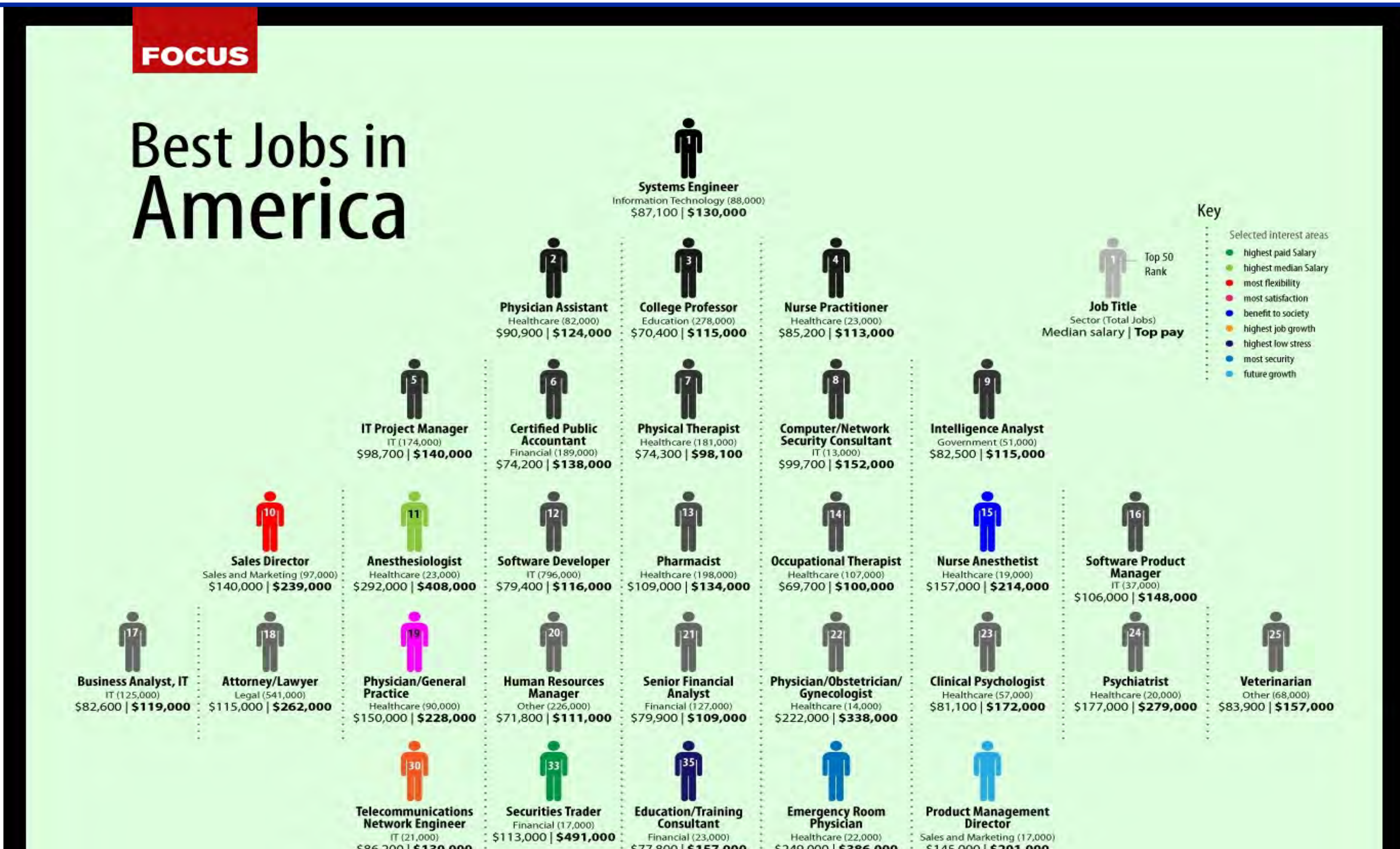
Background: DoD SE Acquisition Workforce

- Legislation And Policy Direction
- Current DoD Efforts
- Systems Engineering – The Best Job in America?

Workforce Development Legislation and Policy

- National Defense Authorization Act For FY 2006 (NDAA FY06): Human Capital Strategic Plan
- NDAA FY08: Section 852, DoD Acquisition Workforce Development Fund
- NDAA FY09: Weapon Systems Acquisition Reform Act
- 2010 SECDEF and USD(AT&L) Efficiency Initiatives

Systems Engineer - The Best Job in America?



Source: http://www.focus.com/fyi/human-resources/best-jobs/ c 2010 Focus - Used with permission.

Workforce Development

Technical workforce development initiatives across government, industry and academia:

- **Competency Assessments for technical management career fields ("first look" in Q4 2010)**
- **Competency-based certification standards to enable "raising the bar" for workforce performance**
- **Flexible certification framework to encourage professional growth and provide the opportunity for subsequent progression to Program Management**
- **Expanded collaboration with civilian universities and industry associations**

DDR&E/SE Serves as Functional Leader
for over 44,000 Uniformed and Civilian Acquisition Personnel
(SPRDE-SE/PSE and PQM)

Mentoring and Why We Need It

- **Definition: Professional Mentoring Is Mentoring Between An Experienced Person, The Mentor, And A Less Experienced One, The Protégé, To Facilitate The Development Of The Protégé Professionally**
- **The Intent Of The Mentoring Process Is To Facilitate The Pace And Quality Of The New Colleague's Development Into A Competent Practicing Professional**

Successful Mentoring

- **The Most Successful Mentorships Are Those That Are Built On A Shared Understanding Of Both Parties' Expectations From The Relationship, Positive Feelings About One Another, And A Lot Of Optimism About How The Relationship Will Benefit Them Both.**
- **Mentoring Is:***
  - Opportunity To Learn From Someone Who Has "Lived It"
  - Sharing Experiences And Expertise
  - Support, Encouragement, Guidance, Advice
  - Reciprocal
- **Mentoring Is Not:***
  - A Therapy Or Venting Session
  - A Be-All-End-All Source For Development
  - Manager Replacement

*Executive Mentoring Program: Executive Briefing Presentation. Dell, Inc.

Characteristics of a Good Mentor

- **Willing: Best Practice Indicates That Mentors Should Be Willing To Fill The Mentor Role And Not Be Pressured Into Mentoring.**
- **Experienced: In General, A Mentor Should Have A Proven Track Record Of Positive Effect In The Work Environment.**
- **Non-Judgmental: A Mentor-Protégé Relationship Focuses On Developing The Protégé Professionally And Personally. The Protégé Should Feel Free To Discuss Issues Openly And Honestly, Without Worrying About Negative Consequences On The Job.**

Would YOU Be a Good Mentor?

Characteristics of a Good Mentor (cont'd)

- **Good Communicator:**
  - Is Able To Articulate Effective Instructional Strategies
  - Listens Attentively
  - Asks Questions That Prompt Reflection And Understanding
  - Offers Critiques In Positive And Productive Ways
  - Uses E-mail/Social Networking Effectively
  - Efficient With The Use Of Time
  - Conveys Enthusiasm, Passion For Profession
  - Is Discreet And Maintains Confidentiality
- **Professional Competence And Experience**
- **Others ?**

Characteristics of a Good Protégé

- Able To Take Constructive Criticism
- Active Listener
- Good Communicator
- Willing To Stretch To Learn And Try New Things
- Willing To Take Risks (Shoot Higher)
- Be Able To Identify Long And Short Term Career Goals
- Willing To Accept That Those Goals May Change
- Others ?

Benefits of Mentoring for the Mentor

- Recruitment And Retention
- Improving Skills And Knowledge
- Learning Goes Both Ways
- Networking
- Helping Someone Succeed
- Personal Satisfaction

Benefits of Mentoring for the Protégé

- Exposure To Best Practices And Lessons Learned
- Networking
- Receiving Critical Feedback In Key Areas:
  - Communications
  - Work Relationships
  - Technical Abilities
  - Change Management And Leadership Skills
- Acquiring Specific Skills And Knowledge Relevant To Personal Goals
- Better Understanding Of Professional Growth Within The Organization
- Insight Into The Organization's Culture And Unspoken Rules
- Sharing Frustrations And Successes With Someone Who Can Empathize With Where You Are In Your Career

Benefits of Mentoring for the Protégé

Novice Protégé	Seasoned Protégé
•Junior colleague	•Polished colleague
•Little/no job experience	•Extensive job experience
•Needs workplace "survival skills"	•Demonstrates work-place "survival skills"
•Needs briefings on "internal workings" and office politics	•Provides briefings on "internal workings" and office politics

When you enter into a mentoring relationship, you and your protégé become professional partners.

Benefits of Mentoring for the Organization

- Enhances Strategic Mission Initiatives
- Enhances Recruiting and Encourages Retention
- Reduces Turnover Rates
- Improves Productivity
- Enhances Professional Development
- Links Employees With Valuable Knowledge And Information With Those Employees In Need Of Such Information
- Creates A Mentoring Culture For Continued Employee Growth And Development
- Provides An Effective Mechanism For Quickly Answering Questions Or Concerns

Mentoring Models

The Tennessee Valley Chapter of Women in Defense (TVC WID) is building a dynamic **Mentor Protégé Program** that will provide **professional development and networking opportunities** in support of Women in Defense. The program is being designed in a way that recognizes and respects the needs, expectations, and life-demands of professional women and those just starting their careers.

One of the essential steps in establishing a viable program is attracting a strong group of **Mentors** to anchor the first Cohort FY11 and we are now accepting brief bio/resumes from members who want to serve and are willing to commit to the following:

- A minimum of 4 hours per month investment per Protégé (maximum of two Protégés allowed per Mentor)
- A one year commitment to the Mentoring Program
- A desire to grow professionally through Mentor-Protégé relationships

Please express your interest by submitting a half page summary about yourself to include:

- Name
- Current Position
- Brief Career History (including years of professional experience)
- Length of Time in Huntsville
- Education
- Relevant Strengths, Skills, and Interests

Why You Wish to Volunteer to be a Part of the FY11 **TVC WID Mentoring Program**

Please include your contact information and email your Bio directly to Paulette Risher at risherp@msn.com **AND** Kathy Broad at broadk@qtecinc.com no later than July 25rd. Our first year FY11 planning is underway and we are excited about the Mentoring Program being a rewarding and fun effort sustained by the diversity and leadership you bring to WID.

LinkedIn

- Contacts
- Groups
- Jbs
- Inbox (1)
- More...

Find People, Jobs, Answers, and More Search for:
Advanced

Mentors and Mentees

Mentors Helping Mentees
Mentees Helping Mentors

We all learn from each other. The main goal is to pair individuals up wth other individuals that can coach one another remotely. Please join the other site as well at mentormentee.collectivex.com so you may use the discussion groups.

About this Group **About this Group**

- **Created:** June 3, 2008
- **Type:** Networking Group
- **Members:** 75
- **Subgroups:** 2
- **Owner:** John M.
- **Managers:** Pat DeLassus
- **Website:** http://mentormentee.collectivex.com

Subgroups

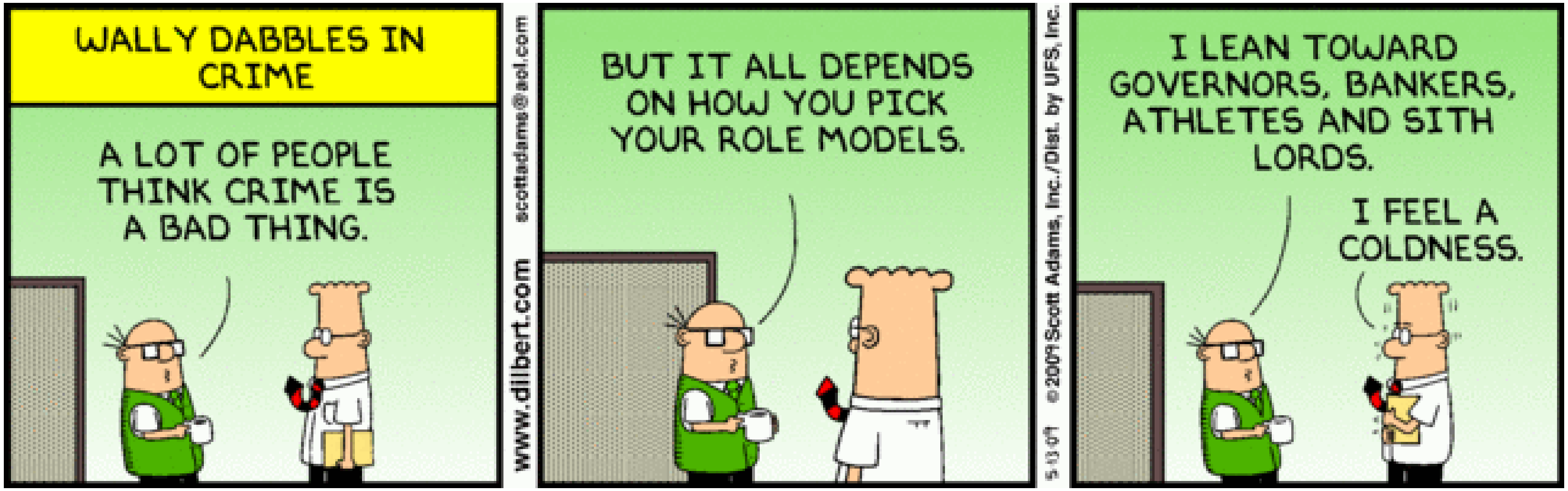
- **Helping a Small Business Owner**
- 4 members | Forward | Join
- **Technology**
- 1 member | Forward | Join

Mentoring Models (cont'd)

- Traditional Mentor-protégé Relationship
- E-mentoring
- Another Model Allows The Mentor To Be A Referral Person, Not The Person With All Of The Answers
- Self-Mentoring

DILBERT: (c) Scott Adams/Dist. by United Feature Syndicate, Inc.

Matching Mentor with Protégé



Matching Mentor with Protégé

- **Match Mentors And Protégés; Areas To Consider Are:**
  - The Available And Willing Mentors
  - Mentor And Protégés' Strengths And Weaknesses
  - Learning Styles
  - Goals Of The Organization/Agency Or The Mentor Program

"Matching is, without a doubt, the single most critical success factor to a formal corporate mentoring program". – Deb Bauer, Program Managers of Dell's Global Diversity Department

Matching Mentor with Protégé

CNN World News
August 25th, 2010
10:20 AM ET

Mentoring session turns into a shootout

Two coalition service members, an Afghan police officer and one civilian were killed in western Afghanistan on Wednesday when a mentoring session turned into a shootout, military officials said.

Officials with NATO's International Security Assistance Force were trying to determine what caused the shooting.

The shooting apparently happened during a mentoring session between coalition soldiers and the Afghan national police, coalition officials said in a statement.

During the mentoring session, an Afghan officer began firing a gun and the coalition soldiers returned fire, the statement said.

The incident, which occurred in the Badghis province, was followed by a demonstration by locals in the area, according to the statement.

Tips for Mentors

- **The First Session Should Take Place In Person, But May Be Conducted By E-mail Or On The Telephone**
- **A Face-to-Face Meeting Should Be In A Neutral Setting Without Distractions Or Interruptions.**
- **Discuss The Protégé's Expectations.**
  - Where Do You Want Your Career To Go?
  - Develop A Meeting Schedule With Your Protégé

Tips for Mentors

- Listen, Counsel, Coach, Advise On Career And Goal Setting To Help Protégé Develop Individual Career Development Plan
- Evaluate Each Meeting With The Protégé
- Most Mentor Research Describes That 90 Percent Of The Mentor-Protégé Relationships Work Out Well
- When Developing A Mentor Program, The Organization/Agency Should Address How A Mentor And Protégé Pairing That Is Not Successful Will Be Handled
- Conclude The Mentoring Process When Appropriate

DILBERT: (c) Scott Adams/Dist. by United Feature Syndicate, Inc.

BREAK

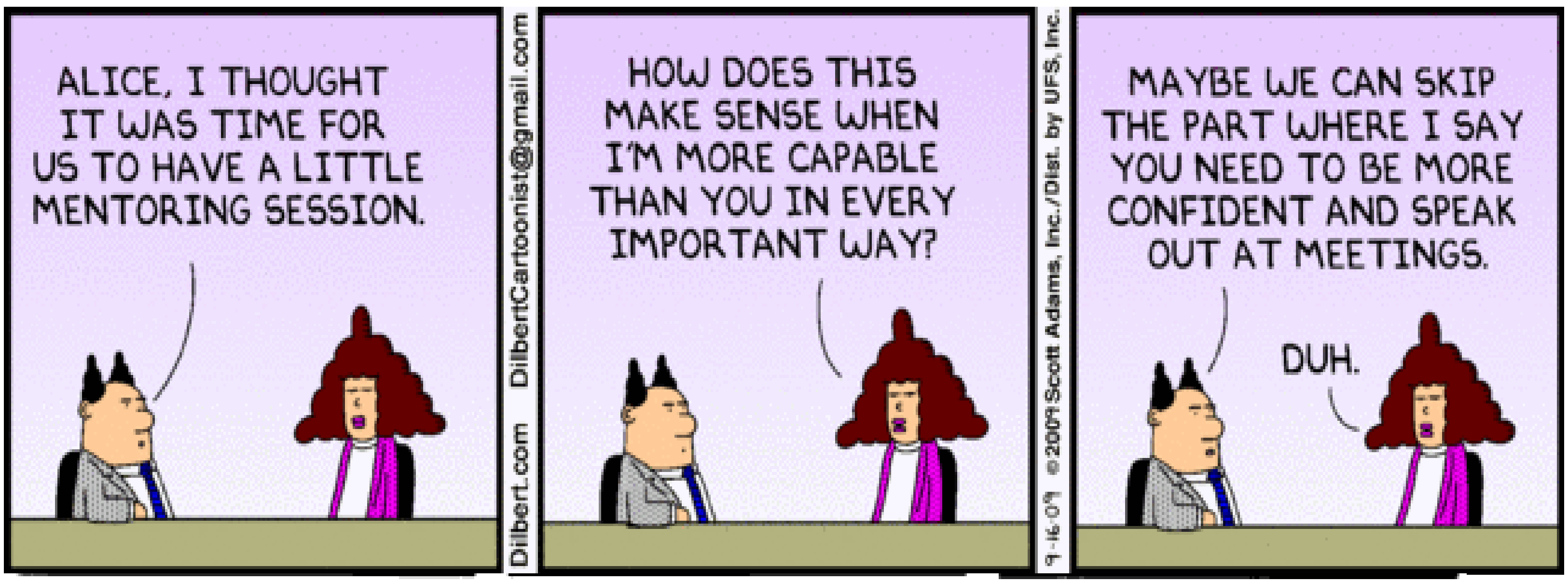
Seven Mentoring Fundamentals

#1: Mentoring Takes Place Outside of a Manager-Employee Relationship, at the Mutual Consent of Mentor and Protégé.

Seven Mentoring Fundamentals

#2: Mentoring is Career-Focused or Focuses on Professional Development that may be Outside a Protégé's Area of Work.

Focus on Professional Development



DILBERT: (c) Scott Adams/Dist. by United Feature Syndicate, Inc.

Seven Mentoring Fundamentals

#3: The Mentorship Relationship is Personal and Confidential; A Mentor Provides Both Professional and Personal Support.

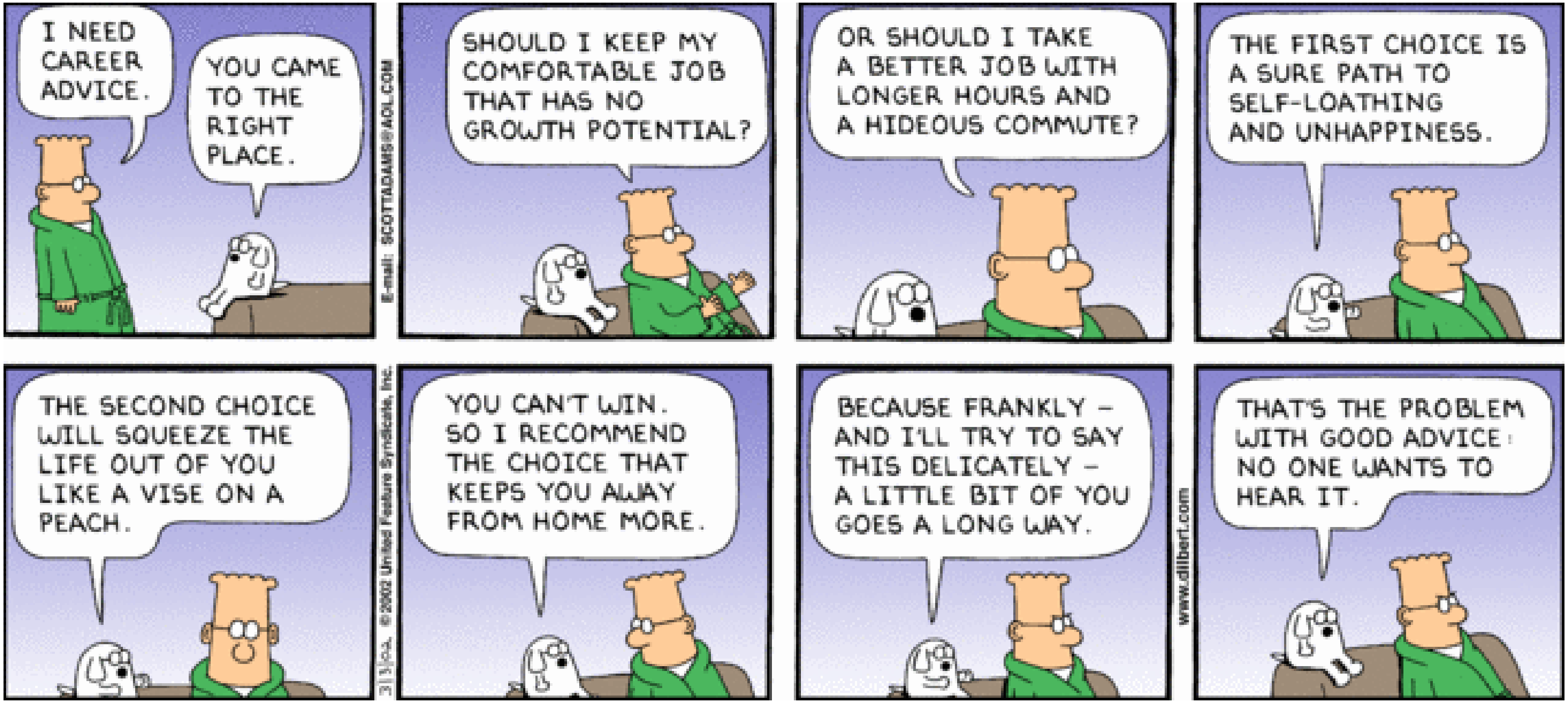
Seven Mentoring Fundamentals

#4: The Mentorship Relationship Crosses Job Boundaries.

Seven Mentoring Fundamentals

#5: A Mentor Will Identify the Protégé's Unique Skills and Capabilities and Work With Him/Her to Make the Most of Those Talents.

Identify the Protégé's Unique Skills and Capabilities



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Seven Mentoring Fundamentals

#6: A Mentor Helps a Protégé Better Understand How the Organization Works (Those Aspects of the Organization that Aren't Written Down)

Seven Mentoring Fundamentals

#7: A Mentor Should Communicate Professional and Organizational Values

Poor Mentoring Practices

- Canceling Appointments
- Not Providing Opportunities For The Protégé To Observe Work In Progress
- Disparaging The Organization/Agency's Processes, Procedures, Or Politics
- Mentor Tyranny, Manipulation or Politicking
- Bad Protégé Actions

Summary

- Give the Mentor-Protégé Relationship Structure
- Recruit Carefully
- Provide Protégé Training & Orientation
- Define Expectations Up Front
- Give Feedback
- Prepare for the End
- Benefit The Mentor, Protégé And The Organization

As The Protégé Grows Professionally, The Amount Of Dependence Decreases, Until The Protégé Is Shaped Into An Independent And Competent Employee.

For Additional Information

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Elizabeth Birdsall

SAIC

703-602-0851 x194

elizabeth.birdsall.ctr@osd.mil

Risk Manage ment and Beyond

2010 NDIA Systems Engineering Conference
San Diego, California

Presented by *Co*
Al Florence

This presenter's affiliation with the MITRE Corporation is provided for identification purposes only and is not intended to convey or imply MITRE's concurrence with or support for the positions, opinions or view points expressed by this presenter.

Agenda

- ***Tutorial Objectives***
- Introduction
- Reasons for Risk/Issue Management
- Opportunities
- Risk Management
- Issue Management
- Risk/Issue Avoidance
- Risk/Issue Opportunities
- Questions/Discussion
- References
- Contact Information

Tutorial Objectives

- Emphasize the importance of identifying and managing program risks and issues
- Clarify the difference between risks and issues
- Present Risk/Issue Avoidance
  - The elimination of the sources of high risk by replacing them with a lower-risk alternatives
  - The establishment of sound technical, programmatic and management practices and activities early and their execution throughout the entire life cycle to reduce risks and issues
- Present opportunities associated with risks/issues
  - When perusing new opportunities risks and issues are encountered
    - By taking calculated risks organizations may realize future opportunities
  - Opportunities to improve program and project performance may surface while resolving risks and issues

Where Are We

- Tutorial Objectives
- ***Introduction***
  - ***Definitions***
- Reasons for Risk/Issue Management
- Opportunities
- Risk Management
- Issue Management
- Risk/Issue Avoidance
- Risk/Issue Opportunities
- Opportunity/Risk/Issue/Opportunity Scenario
- Questions/ Discussion
- References
- Contact Information

Introduction

Definitions

- Risks (IEEE Std 1540-2004; Standard for Software Life Cycle Processes)
  - Program and project risks are the likelihood of an event, hazard, threat, or situation occurring and its undesirable consequences
- Risk (Project Management Body of Knowledge PMBOK)
  - An uncertain even or condition that, if it occurs, has a positive or negative effect on project's objectives
- Issues (QATAR National Project Management)
  - An issue is something currently happening that is having a negative impact on the project and requires resolution for the project to proceed successful
- Issues
  - An issue can be associated with a risk if the risk is realized; has occurred
- Opportunity (The American Heritage Dictionary)
  - A favorable or advantageous combination of circumstances
  - A chance for progress or advancement
- Opportunity (PMBOK)
  - A condition or situation favorable to the project, a positive set of circumstances, a positive set of events, a risk that will have a positive impact on project objectives, or a possibility for positive chances

Introduction

Definitions

- Risk Response
  - The process of developing options and actions to enhance opportunities and reduce threats to project objectives PMBOK
  - Includes Mitigation and Contingencies
  - Includes acceptance of the risk or issue consequence
- Mitigation
  - Risk mitigation implies an elimination or reduction in the probability of risk occurrence PMBOK
- Contingency
  - Issue contingency implies an elimination or reduction of the impact of issues or alternative actions taken

Introduction

- We will start with Opportunities and end with Opportunities
  - Opportunity
  - Risk
  - Issue
  - Opportunity

Introduction

Opportunity
- New weapon system
- New spacecraft
- New micro processor
- New restaurant

Risks

*When attempting a new invention, activity, or project you are taking advantage of an opportunity. But there is always an element of risk associated with these ventures

Issues
- When risks are realized, occur, they become issues
- Issues could arise without being associated with an identified risk

Opportunity

Resolving the risk, or correcting the issue, could surface opportunities to make corrections to keep these risks/issues from recurring (called process improvement)

**Managing Risks, Methods for Software Systems Development; Dr. Elaine M. Hall, SEI Series in Software Engineering*

Where Are We

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Reasons for Risk/Issue Management

- When developing, delivering, and acquiring systems and products
  - developers and acquirers face many challenges
- Challenges can exist with many items and activities:
  - Cost
  - Schedule
  - Technical
  - Management
  - Programmatic
  - Process
  - Performance
  - Others?

Reasons for Risk/Issue Management

- Consequences may be numerous if challenges are not mitigated
  - Cost overruns
  - Late deliveries
  - Technically inadequate
  - Programmatic difficulties
  - Irate management
  - Irate customer
  - Canceled project
  - Loss of market share
  - Missed opportunities
  - Others?

Reasons for Risk/Issue Management

- There are solutions for an organization to help mitigate these challenges
  - Proper program/project management
  - Proper program/project planning
  - Program/project monitoring and control
  - Adequate budgets
  - Adequate schedules
  - Proper requirements development and management
  - Contract tracking and oversight
  - Product evaluation
  - Performance management
  - ***Risk/Issue management***
  - Quality assurance
  - Configuration management
  - Independent Verification and Validation (IV&V)
  - Others?

Reasons for Risk/Issue Management

- It is important to recognize risks and issues early and manage them to reduce or eliminate their impact if they occur
- Often organizations neglect risk and issue management or do not provide sufficient attention to them

Compliance with CMMI ®

- Software Engineering Institute (SEI) Capability Maturity Model Integration (CMMI)
  - CMMI for Development v1.2
  - CMMI for Acquisition v1.2
  - CMMI for Service v1.2
  - V1.3 release soon for all

All have
Risk Management and
*Issue Management
Process Areas

In order for organizations to be compliant with CMMI they need to establish risk and issue management capabilities

* Issue management is implied in the Project Planning, Project Monitoring and Control, Quality Assurance and Configuration Management

Where Are We

- Tutorial Objectives
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- ***Opportunities***
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- Issue Management
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Take Advantage of Opportunities

- Risks are not always undesirable events
  - Taking risks can sometimes be necessary
  - If we are not willing to take calculated risks our advancement in technology and business may be hindered
- We have to be circumspect with the risks we are willing to take
  - And *MANAGE* them properly

Take Advantage of Opportunities

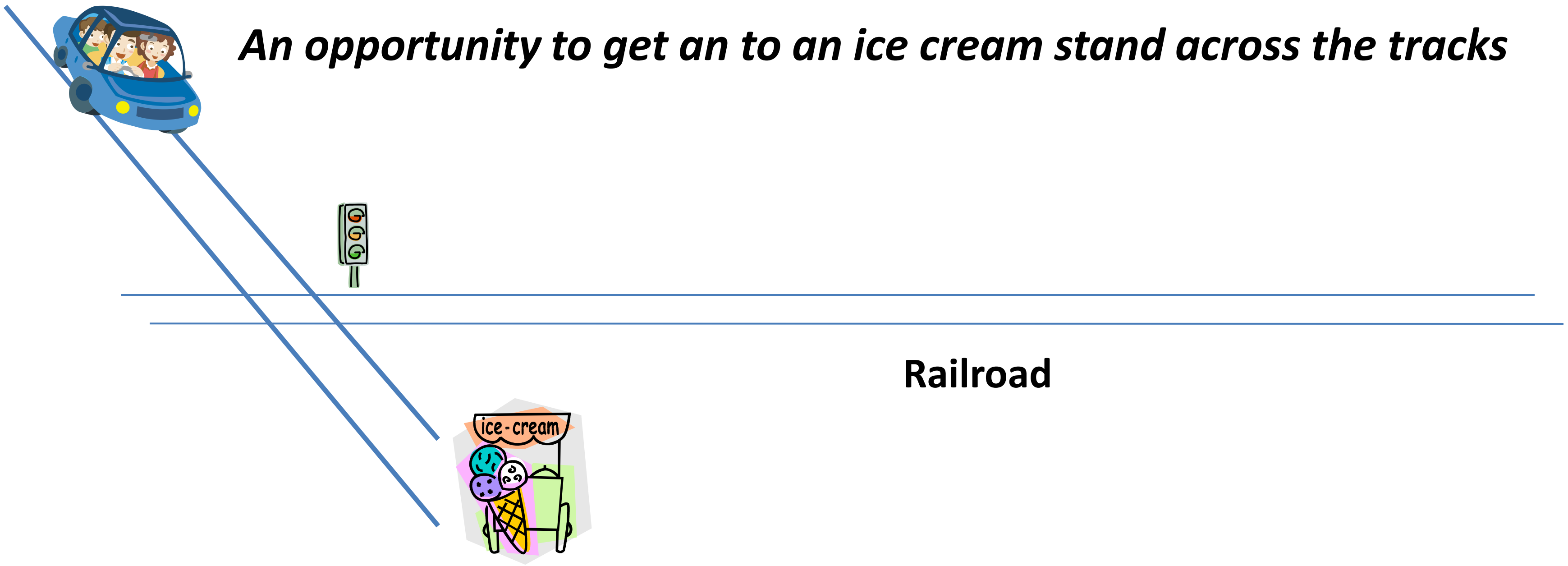
Opportunities/Risks

*Running away from risk is a no-win strategy. Unless your organization has been sound asleep for the past 30 years, all the relatively risk-free opportunities have long since been exploited. The remaining high-opportunity areas are rife with risk. It is in these areas and these alone where you need to focus your attention, skills and resources.

**Managing Risks, Methods for Software Systems Development; Dr. Elaine M. Hall, SEI Series in Software Engineering*

Opportunity

An opportunity to get an to an ice cream stand across the tracks



Where Are We

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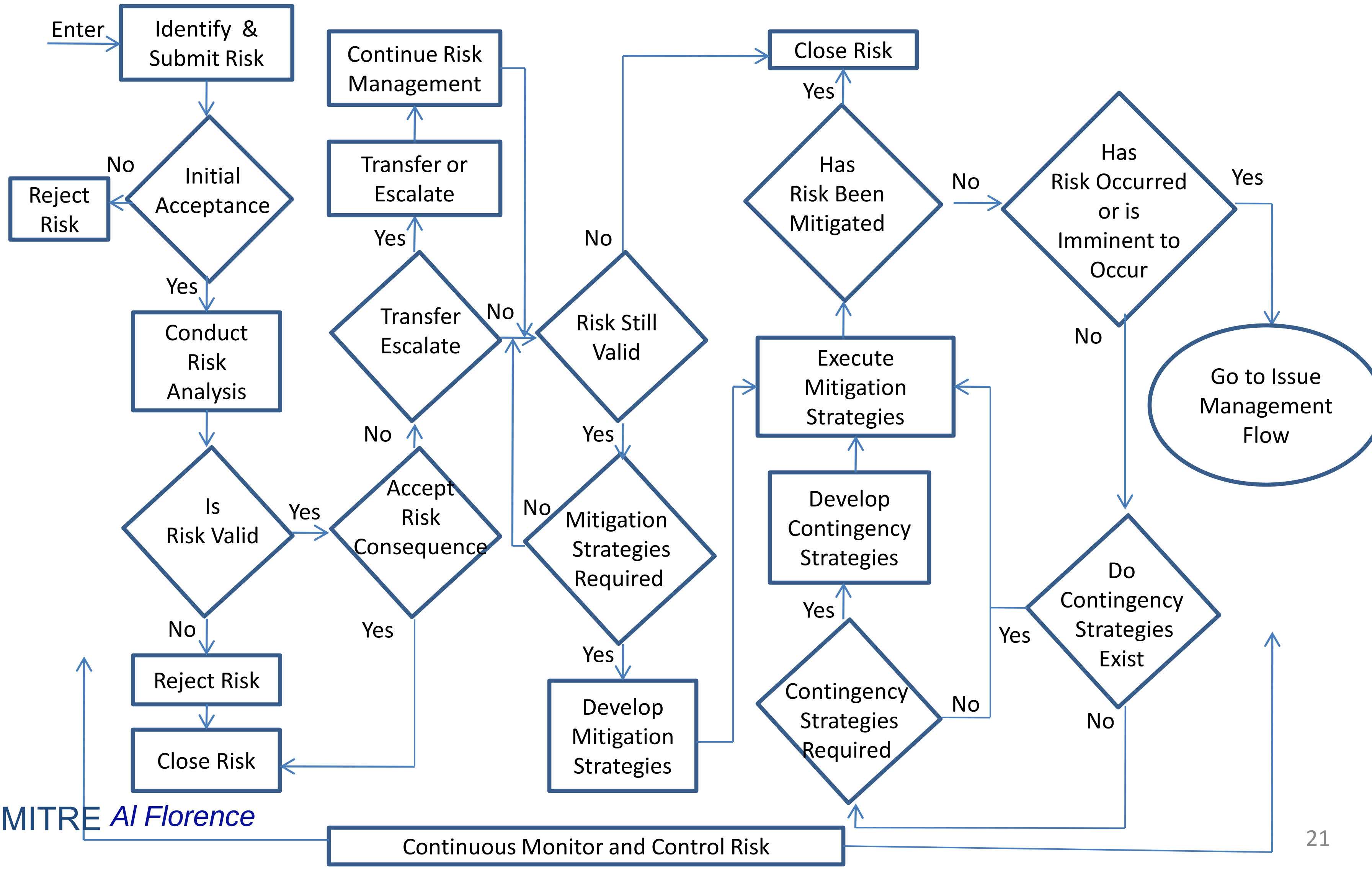
Risk Management Process

- Risk Management is an overarching process that encompasses
  - Risk Planning
  - Risk Identification
  - Risk Analysis
  - Risk Response
  - Risk Monitoring and Control

PMBOK

Risk Management Flow



MITRE *Al Florence*

Risk Management Planning

- Risk management planning is the process of deciding how to approach and conduct the risk management activities for a project
- Planning is important to
  - Ensure the level, type and visibility of risk management are commensurate with both the risk and importance of the project to the organization
  - Provide sufficient resources and time for risk management activities
  - Establish an agreed-upon basis for evaluating risks
- Risk planning should be completed early during project planning

PMBOK

Risk Management Team

- The Risk Managment planning activity may assign a Risk Management Team to administer the Risk Management Program
- A Risk Manager may be assigned to manage the Risk Management Team
- A Risk Management Board may be chartered to review, accept, decline, transfer and escalate risks
- Hierarchy Governance Boards may exist for escalation of risks based on thresholds
- Everyone on the program/project is responsible for risk management

The level of this implementation depends on the size, scope, critically, safety, security, etc. of the application

Risk Management Plan

- Risk management planning needs to be part of project planning
- A risk management plan can be a stand alone plan or part of the project plan
- The risk management plan needs to be tailored to the scope of the application
- The concepts provided in this tutorial can be used to develop the plan

Risk Management Plan Outline

- Introduction
- Project Description
- Risks/Issue/Opportunity Descriptions
- Risk Identification
- Risk Analysis
- Risk Response
  - Risk Acceptance
  - Risk Avoidance
  - Risk Transfer
  - Risk Escalation
  - Risk Mitigation
- Risk Monitor and Control
- Risk Register
- Issue Management
- Issue Contingency
- Risk/Issue Opportunities
- Risk/Issue Training
- Glossary
- References

Risk Management Artifacts

- Risk Management is supported with:
  - Risk Management Policy
  - Risk Management Charter
  - Risk Process Description
  - Risk Management Plan
  - Risk Management Procedures
  - Risk Management Guidelines
  - Risk Management Training
- This presentation will not dwell on these but content of this presentation can support their construction/implementation

Risk Identification

- Risk Identification is the activity that:
  - Identifies potential and current risks
  - Examine elements of the program to identify associated potential root causes of risks
  - Begin their documentation
  - Sets the stage for their successful management
  - Risk identification begins as early as possible in successful programs and continues throughout the life of the program
  - Project and stakeholders from outside and inside the project should be involved in risk identification

Risk Identification

- Risk can be associated with all aspects of a program; e.g.
  - Requirements
  - Threat
  - Security
  - Technology maturity
  - Supplier capability
  - Design
  - Schedule
  - Cost
  - Performance
  - Etc.

Risk Description

- As risks are identified it is important to correctly describe them
- A well-written risk statement contains three main components:
  - Cause – The negative <u>conditions</u> that currently exist relative to the risk
    - Identification of root cause(s) of the risk
    - This provides justification that a risk exists
  - Probability of Occurrence – The <u>likelihood</u> of the occurrence of the risk
    - Within a future time frame
    - Or a future event
  - Consequence – The <u>effect(s)</u>, negative impact(s) to the program(s) in case the risk occurs
    - The consequence should be related to at least cost, schedule, scope and performance
    - Consequence could also result in opportunities that may surface in correcting the problems

Risk Description

- The risk is written in a chain of: Cause: IF; THEN

Example

An Interface Working Group has not been formed and a plan to form one does not exist. **IF** key stakeholders cannot agree on interface protocol by 10/25/2010; **THEN** the schedule for development and delivery will be delayed causing cost overruns.

NOTE: The cause includes assurance that the reason for the risk is valid. I.e., is there a compelling reasons(a root cause) to assume that stakeholders cannot agree on the interface protocol by 04/26/2010? *Not just pie in the sky.*

Risk Description

- Proper risk descriptions helps manage the right risks
  - Risk management is time and resource consuming
  - Managing “non-risks” is not cost effective
- Example
  - A risk may be identified as a risk that component YYY will be provided late
  - Writing this risk as:
    - **IF** component YYY is delivered late; **THEN** ...
  - May fail to inspire interest and action
    - The risk is too vague, or
    - There is no clear reason why this is a risk
  - In this case one needs to identify causal conditions that may prevent timely delivery of YYY. *If there are none this is not a risk!*

Risk Description

- The cause may be included in the "IF" statements for some risk**s**

IF scheduled delivery of component YYY continues to slip beyond 10/25/2010; **THEN** system integration will also slip causing the system to incur cost and schedule overruns.

- Cause
  - Written in the IF statement
  - Schedule continues to slip
- Occurrence
  - Schedule delivery slips beyond 04/26/2010
- Consequence
  - Cost and schedule overruns

Risk Description

- Avoid writing the mitigation strategy into the risk description
  - A mitigation strategy is developed after the risk has been approved and analyzed

Examples

Requirements have always been a problem in passed projects within this organization. **IF** requirements are not reviewed and verified; **THEN** requirement defects will migrate into the design**.**

- Reviewed and verified are possible mitigation strategies
- Write the risk in a chain of cause, occurrence, consequence

Requirements have always been a problem in passed projects within this organization. **IF** defective requirements are not discovered and corrected by PDR; **THEN** requirements defects will migrate into the design and implementation causing rework, and cost and schedule impacts.

Risk Description

- Risks must be written in a clear, concise and unambiguous fashion
- Words and phrases that may have confusing and multiple interpretations must be avoided

Ambiguous Words

- Avoid ambiguous words in describing risks, some examples:
  - Adequate
  - Ad hoc
  - All
  - Always
  - Appropriate
  - Clearly
  - Easy
  - Existing
  - Fast
  - Flexible
  - Future
  - If required
  - Immediately
  - Large
  - Light
  - Limited
  - Near real time
  - Periodic
  - Portable
  - Rapid
  - Several
  - Slow
  - Small
  - Sometimes
  - State of the art
  - Sufficient
  - Usable
  - User-friendly
  - Weight
  - When required
  - Others?

From IEEE standards and some preparatory requirements management plans

Also: http://www.ppi-int.com/newsletter/SyEN-017.php#article

Risk Analysis

- The risk is submitted to the Risk Management Board
- The risk is accepted or declined by the Board
  - If declined rational is conveyed to the submitter
- If accepted the Risk Management Board assigns:
  - A Risk Analyst responsible for conducting risk analysis on assigned risks
    - Supported by Subject Matter Experts (SMEs)
  - A Risk Owner responsible for ensuring risks are properly managed throughout their life
  - Risk Analyst and Owner could be one in the same

Risk Analysis Components

- Risks have the following components:
  - A future root cause(s) (yet to happen) which
    - if eliminated or corrected, would prevent a potential consequence from occurring
  - A probability of occurrence (or likelihood)
    - assessed at the present time and updated when necessary of the future root cause occurring
  - The consequence (or effect/impact) of that future occurrence
  - The time horizon during which the consequences will occur if the risk is not mitigated
  - Risk Priorities
    - Mapping of probability of risk occurrence and risk consequence
  - Risk Triggers
    - Specific events or conditions that indicate when to develop and execute mitigation or contingency strategies

.

Risk Analysis

- **Qualitative Risk Analysis**
  - Relative measure of risk or asset value based on ranking or separation into descriptive categories such as low, medium, high; not important, important, very important; or on a scale from 1 to 10.

    BusinessDictionary.com
  - An examination and prioritization of the risks based on their probability of occurring and the impact on the project if they do occur. Qualitative risk analysis guides the risk reaction process.
    pmpbank.googlepages.com/glossary
- **Quantitative Risk Analysis**
  - Incorporates numerical estimates of frequency or probability and consequence. In practice, a sophisticated analysis of risk requires extensive data which are expensive to acquire or often unavailable. Fortunately, few decisions require sophisticated quantification of both frequency and consequences
  - Shortly spoken one might say that "quantitative risk analysis breaks down risks from a high medium low ranking to actual numerical values and probabilities of occurrence" for being able to compute the overall effects

    (comp. CROSSWIND7, p. 423)

Root Causes

- A future root cause is the most basic reason for the presence of a risk
- The cause of the risk has to be isolated and defined
  - Root causes should be initially identified when risks are identified
  - Once initial root cause are identified they may need to be analyzed further to determine the actual deep rooted causes of the risks
  - Root causes are documented and they support:
    - Establishing risk mitigation and contingency strategies
    - Improvement opportunities
- Root causes can also be referred as risk drivers

Root Cause Analysis. An analytical technique used to determine the basic underlying reason that causes a variance or a defect or a risk. A root cause may underlie more than one variance or defect or risk. ((PMBOK® Guide) -- Fourth Edition) Syn: root-cause analysis

Root Causes

- Typical root causes may be associated with:
  - Threat
  - Requirements
  - Technical Baseline
  - Test and Evaluation
  - Modeling and Simulation
  - Technology
  - Logistics
  - Management
  - Schedules
  - External Factors
  - Budget
  - Earned Value Management
  - Production
  - Industrial Capabilities
  - Cost
  - Others?

Root Causes

Background Information

- <u>Threat</u> - The sensitivity of the program to uncertainty in the threat description, the degree to which the program would have to change if the threat's parameters change
- <u>Requirements</u> - The sensitivity of the program to uncertainty in the system requirements
- <u>Technical Baseline</u> - The approved and fixed configuration of a technical item at a specific time in its lifecycle that serves as a reference point for change control
- <u>Test and Evaluation</u> - The adequacy and capability of the test and evaluation program to assess attainment of significant performance specifications and determine whether the system is operationally effective, operationally suitable, and interoperable with the system

Root Causes

Background Information

- Modeling and Simulation - The adequacy and capability of M&S to support all life-cycle phases of a program using verified, validated, and accredited models and simulations
- Technology - The degree to which the technology proposed for the program has demonstrated sufficient maturity to be realistically capable of meeting all of the program's objectives
- Logistics - The ability of the system configuration and associated documentation to achieve the program's logistics objectives based on the system design, maintenance concept, support system design, and availability of support data and resources

Root Causes

Background Information

- Management - The degree to which program plans and strategies exist and are realistic and consistent. The program support team should be qualified and sufficiently staffed to manage the program
- Schedule - The sufficiency of the time allocated for performing the defined tasks
- External Factors - The availability of resources external to the program that are required to support the program such as facilities, resources, personnel, government furnished equipment, etc.
- Budget - The sensitivity of the program to budget variations and reductions and the resultant program turbulence
- Earned Value Management (EVM) - The adequacy of the EVM process and the realism of the integrated baseline for managing the program

Root Causes

Background Information

- Production - The ability of the system configuration to achieve the program's production objectives based on the system design, manufacturing processes chosen, and availability of manufacturing resources
- Industrial Capabilities - The abilities, experience, resources, and knowledge of the contractors to design, develop, manufacture, and support the system
- Cost - The ability of the system to achieve the program's life-cycle cost objectives. This includes the effects of budget and affordability decisions and the effects of inherent errors in the cost

Probability of Occurrence

- Probability of occurrence assessed, at the present time, is the probability of a future root cause occurring
- The chance of a risk occurring is rated on a scale between >0 and 1
- When the probability of occurrence = 1; (100%)
  - The risk has occurred; it then becomes an issue and is managed as an issue
- For most risks, estimating the precise probability of occurrence may be difficult
  - Analysis by SMEs may be necessary, and often using Best Engineering Judgment

Probability Scores

- Probability of occurrence may begin with a qualitative description of probability, which will tie to a numeric range of probability.

Sample Risk Probability Scores

Probability Description	Probability % of Occurrence
Very High (Extremely likely)	≥81% and =100%
High (Probable)	61% – 80%
Medium (Possible)	41% – 60%
Low (Unlikely)	21% – 40%
Very Low (Highly improbable)	>I% – ≤20%

Consequence of Risk Occurrence (Impact)

- Risks are reviewed for the effect that they would have on the project's objectives and other elements of the program
- The level of impact, may be rated from very low (1) to very high (5), and is assessed against at least four categories:
  - Cost
  - Schedule
  - Scope
  - Performance

Consequence of Risk Occurrence

Program/Project Objective	**Very Low** Minor	**Low** Moderate	**Medium** Serious	**High** Critical	**Very High** Catastrophic
Cost	Insignificant increase	Increase < 2% of budget baseline	Increase 2–5% of budget baseline	Increase 6–10% of budget baseline	Increase > 10% of budget baseline
Schedule	Insignificant slippage	Slippage < 2% of project baseline schedule	Slippage 2–5% of project baseline schedule	Slippage 6–10% of project baseline schedule	Slippage > 10% of project baseline schedule — OR — Slippage past a milestone mandated by Congress
Scope	Scope decrease barely noticeable	Minor areas of scope affected	Major areas of scope affected	Scope reduction unacceptable to sponsor	Project outcome is effectively useless
Performance	Performance degradation barely noticeable	Performance degradation noticeable, but does not fail acceptance criteria	Performance reduction requires sponsor approval	Performance reduction unacceptable to sponsor	Project outcome is effectively useless

Time Horizon

- There are at least three dates that may be specified for each risk:
  - Near risks are those in which the earliest date of the risk impact is within xx days of the present date
  - Mid risks are those in which the earliest date of risk impact is between xx and zz days from the present date
  - Far risks are those in which the earliest dates of the risk impact are greater than zz days from the present date

  (xx<zz)
- These dates are used as triggers to track when the risk will begin to impact the program and/or when the risk has been overcome by events

Risk Exposure

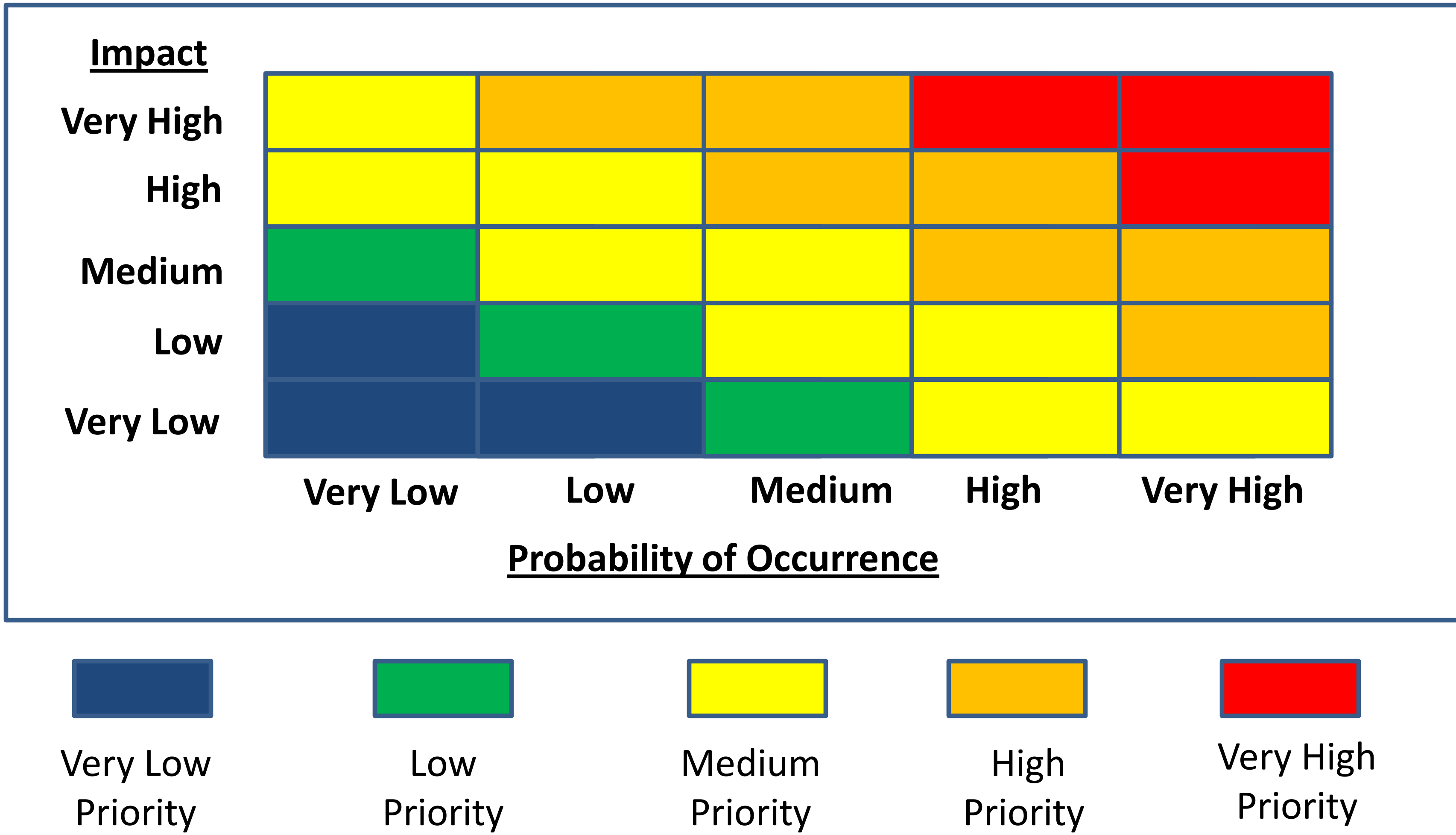
- Risk exposure. (ISO/IEC 16085:2006 Systems and software engineering--Life cycle processes--Risk management

  (1) the potential loss presented to an individual, project, or organization by a risk

  (2) a function of the likelihood that the risk will occur and the magnitude of the consequences of its occurrence

- Risk exposure can also be called **Risk Priority**
  - The priority of a risk helps to determine the amount of resources and time that should be dedicated to managing and monitoring the risk
  - Very Low, Low, Medium, High, and Very High priority is assessed by using probability and impact scores
  - The potential timing of a risk event may also be considered when determining risk management actions

Risk Priorities



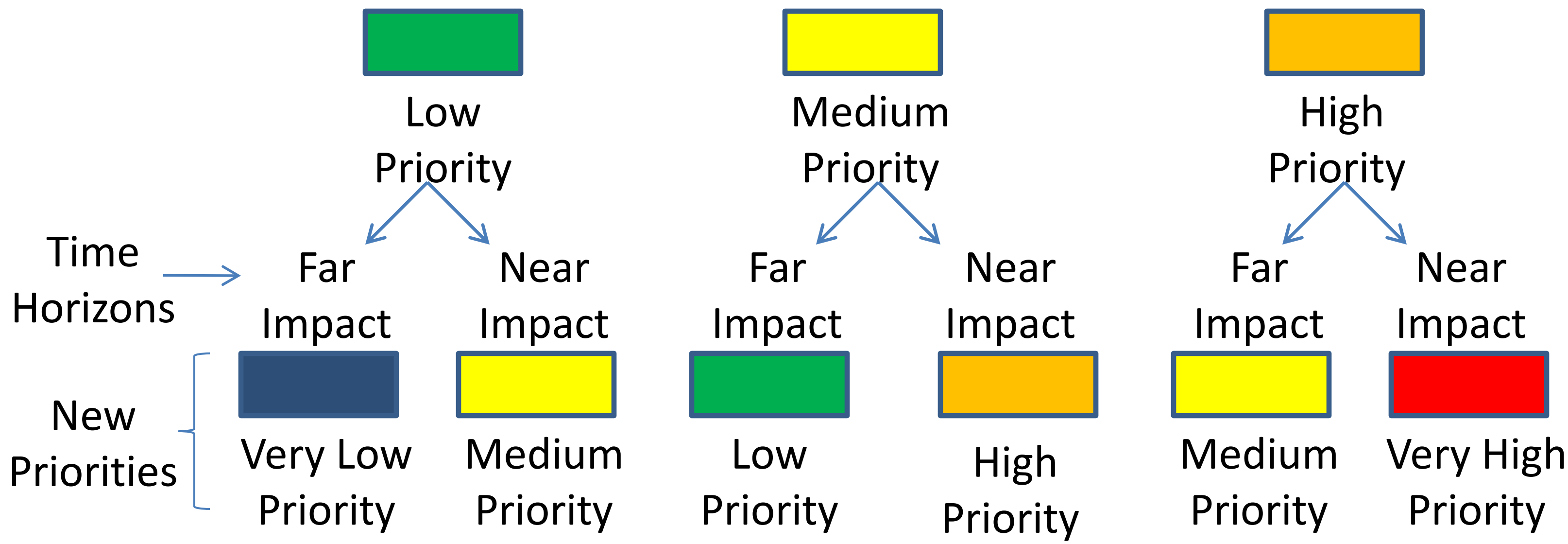
Risk Priority vs. Mitigation/Contingency

Very Low Priority	Low Priority	Medium Priority	High Priority	Very High Priority
↓	↓	↓	↓	↓
Risk Watch List	Monitor	Monitor Develop Mitigation Strategy	Monitor Develop Contingency Strategy	Monitor

Very Low Priority Risks are placed in a Risk Watch List which are periodically monitored.
Other Risks are monitored more aggressively.

Risk Priorities & Time Horizon

The potential timing of a risk event may also be considered when determining risk management actions



Time Horizons may influence the Risk Priority

(Mid Time Horizon should not influence risk priority change)

Priorities may change over time

Identifying Triggers

- Triggers are specific events or conditions that indicate when to execute mitigation or contingency strategies
- Unless a condition is immediate, a trigger should be defined
- Examples of triggers may include:
  - Cost performance
  - Schedule performance
  - Results of management reviews
  - Occurrence of the risk
    - as a trigger for execution of contingency strategies

Risk Response

- Risk response is the process of developing options and determining actions to enhance opportunities and reduce threats to the project's objectives
- Risk response must be
  - Appropriate to the significance of the risk
  - Cost effective in meeting the challenge
  - Timely and realistic within the project contend
  - Agreed to by all parties involved

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Risk Response

- Risk Responses has at least five components
  - Acceptance
  - Avoidance
  - Transfer
  - Escalate
  - Mitigate *(contingencies – for issues)*
- Acceptance – Accept the consequences of the risk occurring
  - Other responses may not be possible
  - Cost to respond may be greater than the benefit
  - May not be possible to prevent the impact if the risk occurs
  - Impact may be negligible
  - Risk may be imminent and should be handled as an issue

Risk Avoidance/Transfer

– Avoidance *(covered later in presentation)*
  - Eliminate the sources of high risk and replace them with a lower-risk alternative
  - Risk avoidance with good management and engineering practices
– Transfer - Shift the responsibility of managing and resolving the risk to another party
  - May be better able to manage the risk
  - May be the proper owner of the risk
  - Transfer could be from one party to another within the same organization
  - Transfer could be to a completely different organization

Risk Escalation

- Escalation - Risks should be managed at the lowest practical level
  - But conditions may arise where a risk should be escalated to higher levels of management or beyond the program/project
  - The next higher organizational (Governance) entity may be able to better to handle the risk/issue
  - Thresholds may exist that determine escalation
    - Cost of impact
    - Schedule effect of Impact
    - Scope of impact
    - Performance effect of impact
    - Time critical
    - Cost critical

Risk Mitigation

- Taking early action to reduce the probability and/or impact of a risk occurring is often more effective that trying to repair the damage after the risk has occurred
- Adapting less complex processes, conducting more tests, or choosing a more stable supplier are examples of mitigation actions

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Risk Mitigation

- The following are important guidelines for effective risk mitigation:
  - Prepare detailed mitigation strategies for all medium, high and very high risks
    - With sufficient detail about what is to be done, when, where, and by whom
  - Develop mitigation strategies as early as possible, allowing time to address risks needing special attention or action
    - Helps reduce the chance of having high-priority risks appear at the last moment on the critical path
  - Prepare contingency strategies for all high and very high priority risks and risks imminent to occur

Risk Mitigation

Background Information

- Adaptations of the following strategies can be applied to a range of risks. This list is intended merely as a starting point for thinking about risk mitigation
  - Multiple Development Efforts - Create competing systems in parallel that meet the same scope and performance requirements
  - Alternative Design - Create a backup design option that uses a less risky approach
  - Trade Studies – Conduct studies to arrive at the least risky solution
  - Early Prototyping - Build and test prototypes early in the system development
  - Incremental Development - Design with the intent of upgrading system parts in the future

Risk Mitigation

Background Information

– Technology Maturation Efforts - Normally, technology maturation is used when the desired technology will replace an existing technology that is available for use in the system

– Robust Design - This approach, while it could be more costly, uses advanced design and manufacturing techniques that promote quality through design

– Reviews, Walk-Throughs, and Inspections - These three actions can be used to reduce the probability/likelihood and potential consequences/impacts of risks through timely assessment of actual or planned events

– Design of Experiments - This engineering tool identifies critical design factors that are sensitive, and therefore potentially high-risk, to achieve a particular user requirement

Risk Mitigation
Background Information

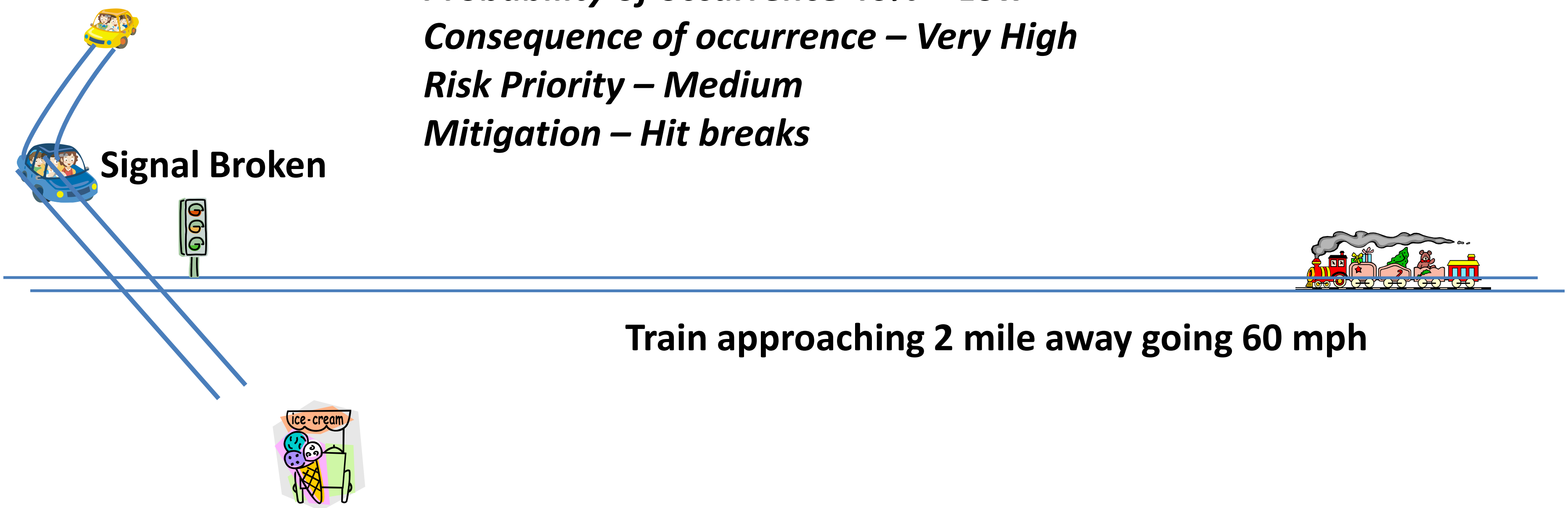
- Open Systems - Carefully selected commercial specifications and standards, which can result in lower risks
- Use of Standard Items/Software Reuse - Use of existing and proven hardware and software, where applicable, can substantially reduce risks
- Use of Mock-Ups - The use of mock-ups, especially man-machine interface mock-ups, can be used to conduct early exploration of design options
- Modeling/Simulation - Modeling and simulation can be used to investigate various design options and system requirement levels
- Key Parameter Control Boards - The practice of establishing a control board for a parameter may be appropriate when a particular feature (such as system weight) is crucial to achieving the overall program requirements

Issue Contingency

- Issue contingencies are developed for high and very high priority risks
- Covered further under issues

Risk

Probability of occurrence 40% – Low
Consequence of occurrence – Very High
Risk Priority – Medium
Mitigation – Hit breaks



Risk Monitoring and Control

- In order to effectively monitor and control risks a Risk Repository needs to be established
  - Also called a Risk Register
- There are many risk tools that provide repository capabilities:
  - Home developed tools
  - Commercial tools
  - Corporate/agency tools

Note: Risk register implementation may depend on project size. A month long project might just need a spread sheet table whereas a multi-year, geographically dispersed project may require an internet and SQL-based database tool.

Risk Control

- Risk control involves:
  – Plan and execute actions that reduce the probability/impact of a risk on the project's objectives (i.e., mitigation); and/or
  – Establish a feasible impact control plan for the realization of the risk (i.e., contingency)
  – Control includes the decision to:
    - Close risks
    - Mark risks as occurred
    - Update probability and impacts and other details (conduct additional analysis)

Risk Records

- Risk and Issue records in a risk/issue repository serve several purposes:
  - Reporting and communicating information to others who might be impacted or who might be able to help manage an item
  - Providing risk lists and status for reviews with stakeholders
  - Assisting the risk originator and owner the collection of information about an item
  - Helping risk owners and others to easily access risk and issue information, and manage that information to the benefit of the organization

Risk/Issue Repository

- Suggested contents of repository
  - Category of risk (schedule, cost, technical, management, etc.)
  - Risk Identifier
    - Unique alpha numeric identifier of each risk/issue
  - Risk Name
    - Descriptive name of risk or issue
  - Risk Description
    - Cause
    - Probability of Occurrence - **IF**
    - Consequence - **THEN**

Risk/Issue Repository

- Suggested contents of repository
  - Stage in which the risk exists at time
    - Analysis, Mitigation, Contingency, Issue, Closed
  - Priority
    - Very Low, Low, Medium, High, Very High
  - Impact
    - Very Low, Low, Medium, High, Very High
  - Probability of Occurrence
    - Larger then zero equal to 1 for risks
    - If 1 it becomes an issue
  - Risk Triggers
  - Mitigation Strategies
  - Contingency Strategies
  - Notes

Risk Monitoring

- Risk monitoring involves
  - Tracking individual risks, primarily by reviewing the status of their mitigation strategies, probability, consequence, and other information
  - Risk Monitoring includes:
    - Continuous reassessment of risks
    - Reporting on risks
  - Continuously analysis and status updates in the Risk/Issue Repository
  - Providing evidence to outside governance bodies that the program and its projects have identified sources of uncertainty and possible failure

Risk Monitoring provides data and status for Risk Control activities

Risk Monitoring

- Critical review makes certain that the solution is fixing the root cause wherever possible and prepares the risk owner and project to answer the following questions:
  - What is the expected reduction of probability and impact? Is it documented? Is it a sufficient reduction?
  - Can the option be feasibly implemented and still meet the user's needs?
  - Is time available to develop and implement the option?
  - Is the mitigation strategy affordable in terms of cost and other resources (e.g., use of critical materials, test facilities, etc.)? Does the benefit outweigh the cost?
  - What effect does the option have on the overall program schedule?
  - What effect does the option have on the system's technical scope and performance?

Risk Monitoring

- Risk reports can be in the form of text reports and/or graphs
- The following are examples of reports and metrics that can be reported:
  - Open Risk/Issues by Priority by Month
  - Closed Risks/Issues Current Month
  - Risk/Issue Plans
    - Current and next month
  - Risk/Issue Transfer Current Month
  - Risk/Issue Escalation Current Month
  - Risk/Issue Activity History
  - Risk/Issue for Management Attention

Risk Status

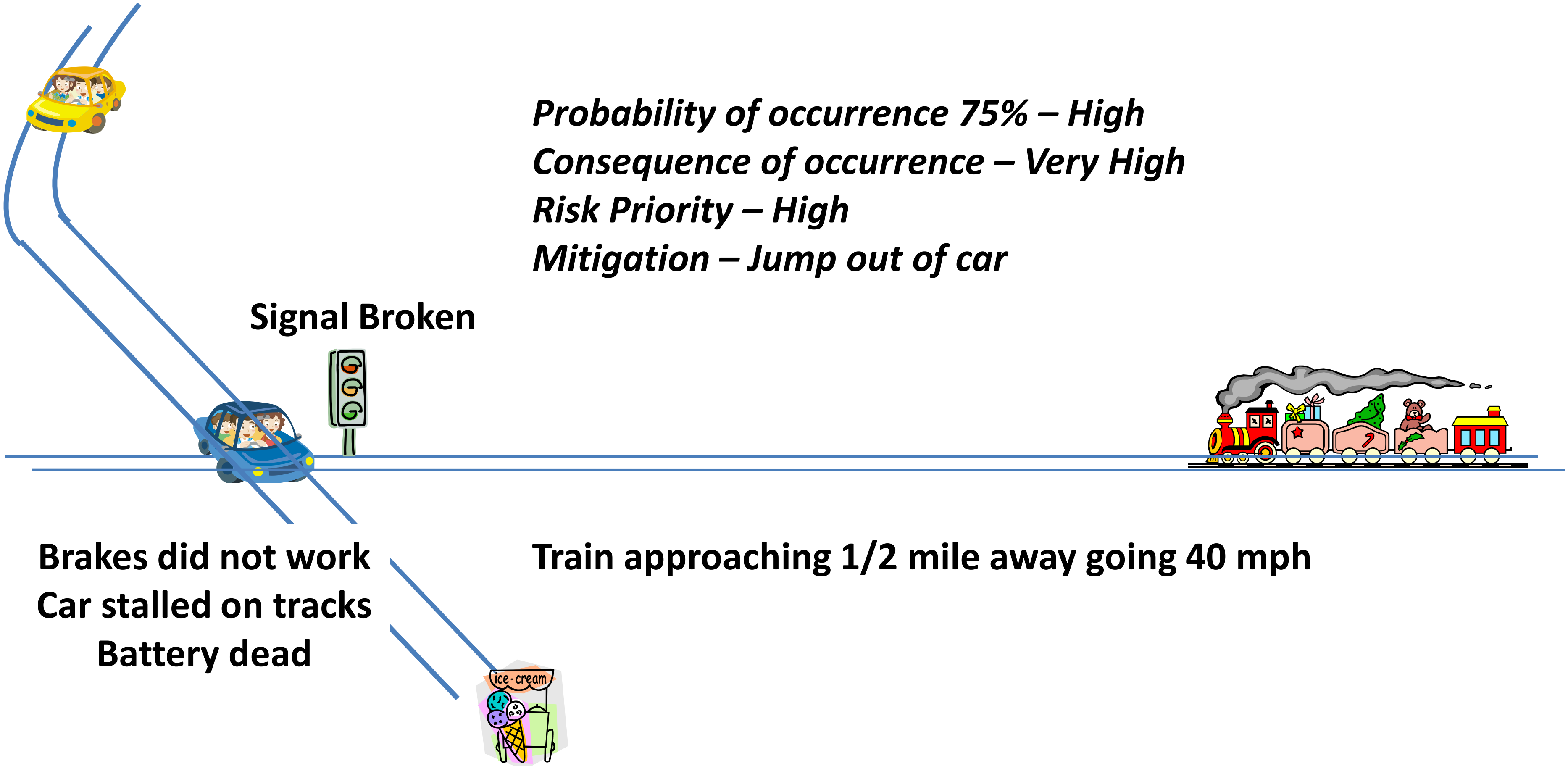
- Risk monitoring includes constant monitoring and providing status of the risks including
  - Analysis the current status of the risks
  - Updates the
    - Probability of occurrence
    - Impact of occurrence
    - Other risk parameters
    - Mitigation strategies
    - Contingency strategies

Risk Closure

- Risks are closed when:
  - They are no longer a threat (the risk lessened or vanished)
  - They have been mitigated
  - They have been transferred or escalated
    - The new owners now manage and monitor the risk
- When risks occur they now become Issues and may be closed as risks or left open in the repository as Issues

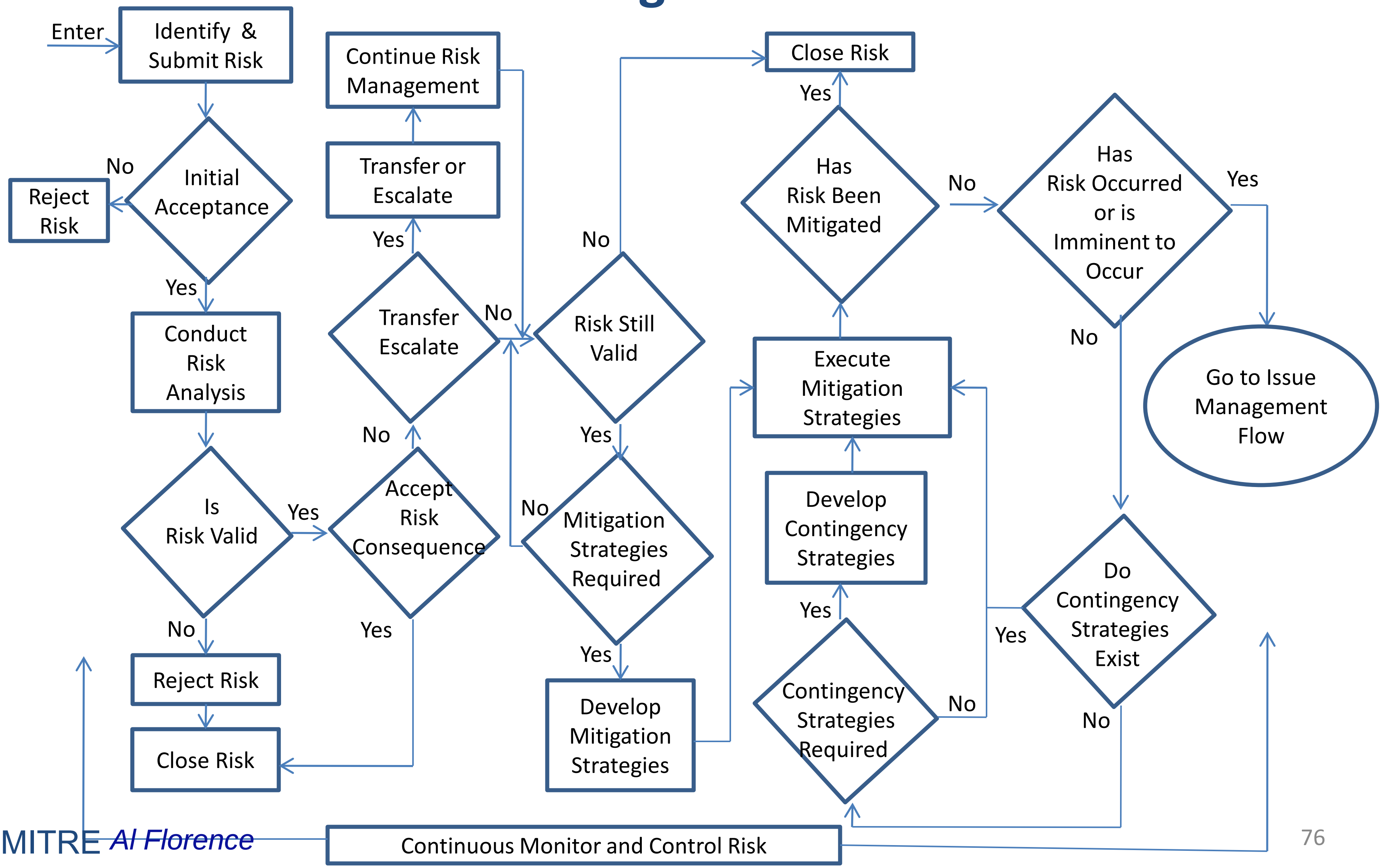
Risk

Probability of occurrence 75% – High
Consequence of occurrence – Very High
Risk Priority – High
Mitigation – Jump out of car



In Review

Risk Management Flow



Where Are We

- Tutorial Objectives
- Introduction
- Reasons for Risk/Issue Management
- Opportunities
- Risk Management
- ***Issue Management***
- Risk/Issue Avoidance
- Risk/Issue Opportunities
- Questions/ Discussion
- References
- Contact Information

Issue Management

- An issue is an event that has occurred or will *occur with certainty* and *adversely affects* the ability of the project or program to meet its objectives

Used in Next slide

a) A formally identified adverse condition related to a program

a1) Had not been identified as a risk prior to its occurrence

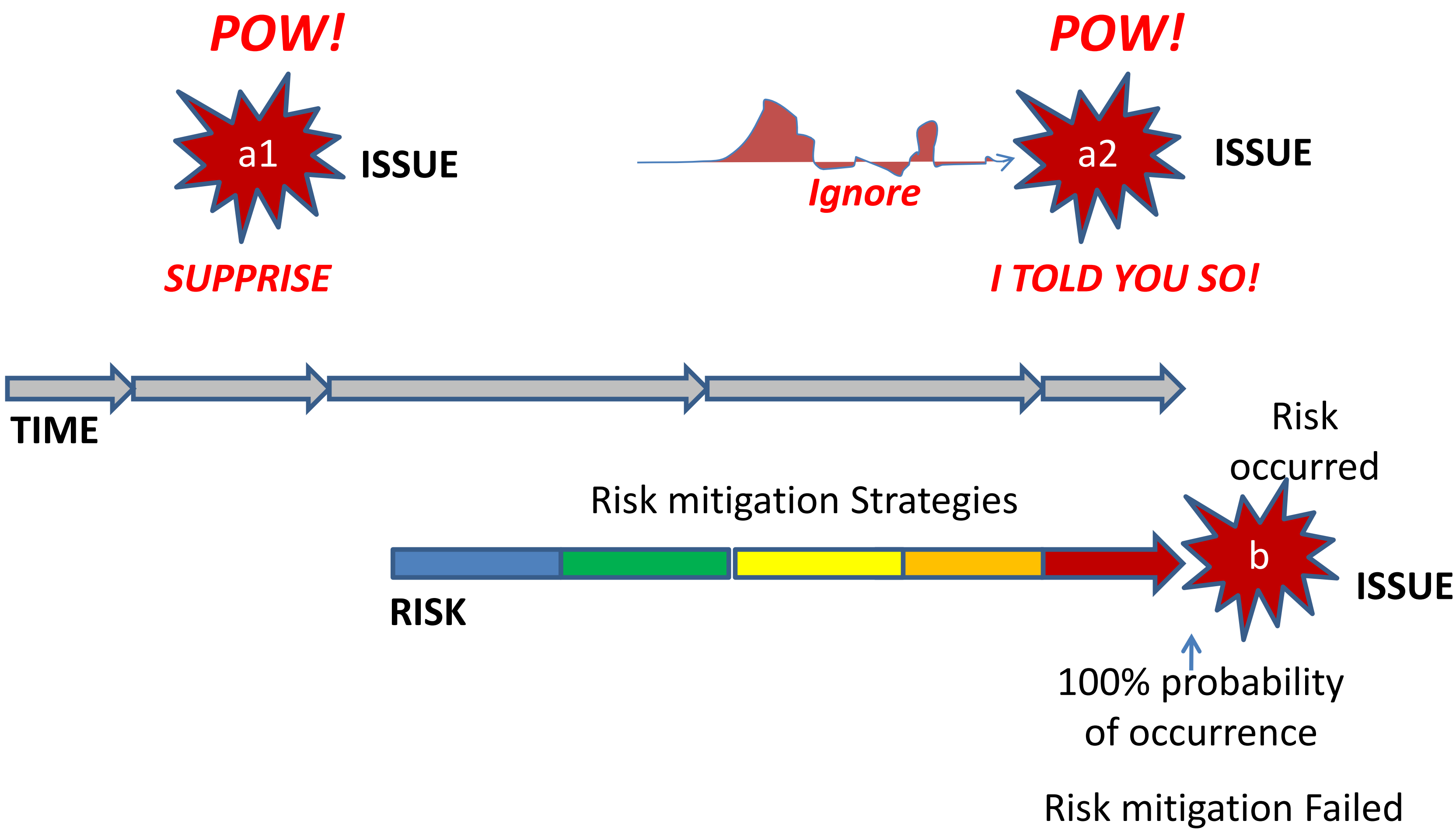
a2) Had been identified as a risk prior to its occurrence but had not been managed as a risk

b) A program risk that has occurred or is imminent to occur

- Reached its probability of occurrence of 1 (one) or 100%
- Not yet occurred but the probability of occurrence is approaching 100%
  - At this time should be managed as an issue

Some concepts from: PM@UTS Learning Program Step by step guide to project management

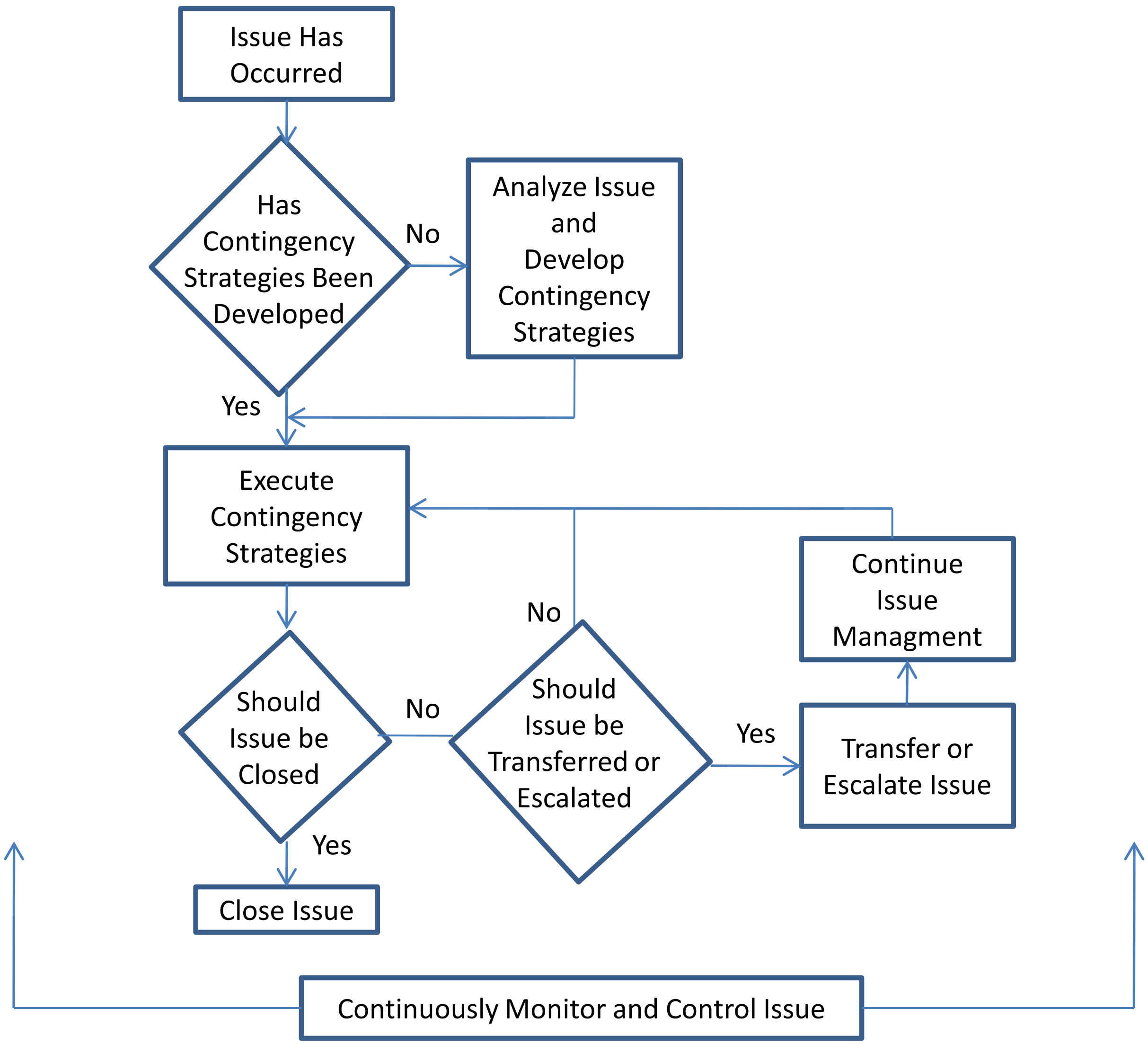
Issue Management



Issue Management

- If program/project issues are not addressed they may:
  - Affect program/project schedule
  - Increase program/project cost
  - Change program/project scope
  - Diminish program/project performance
- Issues can be associated with all aspects of a program (e.g., threat, technology maturity, supplier capability, design, performance against plans) as these aspects relate across the Work Breakdown Structure and Integrated Master Schedule

Issue Management Flow



MITRE *Al Florence*

Issue Management

- Issue Management quickly identifies and effectively resolves problems as they occur and involves:
  - Issue Identification
  - Issue Analysis
  - Issue Response
  - Issue Monitoring and Control

Issue Identification

- Issue identification activities are similar to those for risk identification
- If the issue is one that occurred, without being associated with a risk, then it needs to be identification
- Issue identification would have been done if the issue resulted from a risk occurring
  - Regardless issues may need additional identification
    - Especially in identifying root causes

Issue Description

- If the issue was a risk that occurred it should have been described with the risk description
- If the issue was not related to a risk the issue needs to be described
  - The conditions that caused an issue to occur along with root cause(s) need to be identified and described
    - This includes the consequences of the issue occurrence
  - The risk writing guidelines presented earlier can be used as appropriate to issues

Issue Analysis

- Issue analysis activities are similar to those for risk analysis
  - If an issue is a risk that has occurred, some, if not all, risk analysis may be sufficient for the issue
    - The issue may need additional analysis due to its impact on program/project activities and products
  - If the issue is one that occurred without it being associated with a risk then issue analysis needs to be conducted
    - The root cause needs to be identified
    - Impact level, rated from very low (1) to very high (5), is assessed in at least four categories:
      - Cost
      - Schedule
      - Scope
      - Performance

Issue Response

- Issue response could include
  - Acceptance
    - Accept the consequence of the issue
    - Same reasons as acceptance of risks
  - Transfer
    - If the occurred risk had not been transferred the issue responsibility may now be shifted to another party who is better equipped to deal with the issue
  - Escalate
    - If the occurred risk had not been escalated the issue responsibility may now be escalated to higher authority based on threshold described earlier
  - Contingencies
    - Can be developed using the similar methods described for risk mitigations

Issue Response

- Issue contingencies are strategies to eliminate or reduce the negative effect of the issue
- Issue contingencies should have been developed for issues that were the result of a risk occurring
  - If not they need to be developed
  - They may need to be enhanced
    - If they were associated with risks earlier
- For issues that were not the result of a risk occurring contingencies need to be developed

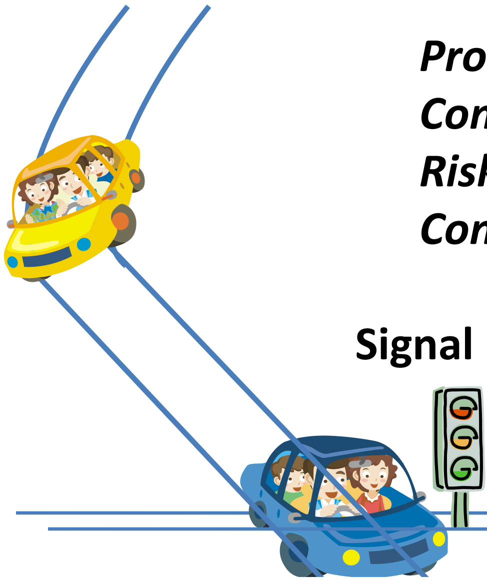
Issue Monitoring and Control

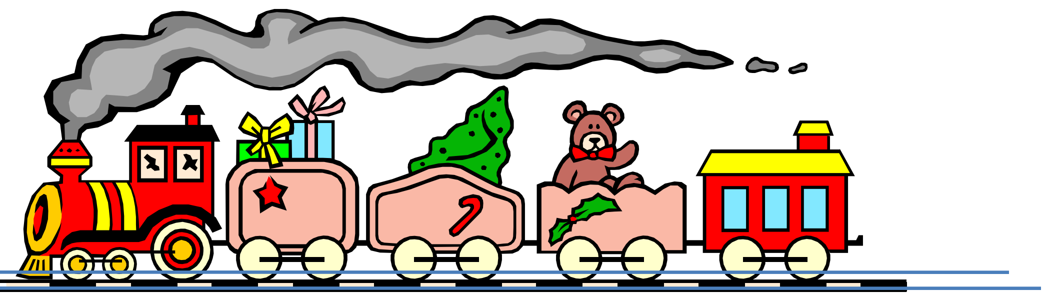
- Issues are monitored and controlled until they are closed
- Issues are monitored and controlled using similar methods described for risk monitoring and control

Risk/Issue

Probability of occurrence 97% – Very High
Consequence of occurrence – Very High
Risk Priority – Very High
Contingency – Pray

Signal Broken





Car stalled on tracks
Battery still dead
Doors jammed

Train approaching 200 yards away going 30 mph

Murphy is for real!

Black Swan Events

***The Black Swan: The Impact of the Highly Improbable*;**

Nassim Nicholas Taleb

WIKIPEDIA

Black Swan Events

- Black Swan Events were described by Nassim Nicholas Taleb in his 2007 book, *The Black Swan*
- Taleb regards almost all major scientific discoveries, historical events, and artistic accomplishments as "black swans"—undirected and unpredicted
- He gives the rise of the Internet, the personal computer, World War I, and the September 11, 2001 attacks as examples of Black Swan Events

We can add the 2004 Indonesian Tsunami, The Haiti Earthquake, Columbia, Challenger, Killer Whale Tilikum, Toyota Recalls-to Stock Holders and Owners, not sure about Toyota Executives - Al Florence

Black Swan Theory

- The Black Swan Theory is used by Nassim Nicholas Taleb to explain the existence and occurrence of high-impact, hard-to-predict, and rare events that are beyond the realm of normal expectations
- Such events are considered extreme outliers

Black Swan Events

- The main idea in Taleb's book is not to attempt to predict Black Swan Events
  – but to build robustness into negative ones that occur and being able to exploit positive ones
- Taleb contends that banks and trading firms are very vulnerable to hazardous Black Swan Events and are exposed to losses beyond that predicted by their defective models
  – *Sounds familiar? Al Florence*
- Taleb states that a Black Swan Event depends on the observer
  – using a simple example, what may be a Black Swan surprise for a turkey is not a Black Swan surprise for its butcher
  – hence the objective should be to "avoid being the turkey" by identifying areas of vulnerability in order to "turn the Black Swans white"

The same can be said about 9/11; Black Swan for Americans, White Swan for terrorists! - Al Florence

Black Swan Bottom Line

- Black Swan Events are events that have an extremely low probability of occurrence
  - cannot be predicted
- But have a very high consequence if occur
  - positive or negative
- Mitigation is near impossible for negative ones since it is not known when, where and how or if they will occur

Al Florence

How about an All Black Penguin?
Discovered March 11, 2010 near Antarctica
One in a zillion occurrence
So, what would a All Black Penguin event be?

Where Are We

- Tutorial Objectives
- Introduction
- Reasons for Risk/Issue Management
- Opportunities
- Risk Management
- Issue Management
- ***Risk/Issue Avoidance***
- Risk/Issue Opportunities
- Questions/ Discussion
- References
- Contact Information

Risk/Issue Avoidance

- Risk/Issue Avoidance has at least two components:
  – Eliminate the sources of high risks and issues and replace them with a lower-risk alternatives
  – The establishment of sound technical, programmatic and management processes, and activities early and their continued execution throughout the entire lifecycle
    - This helps remove common risks/issues root causes

Low-Risk Alternatives

- Eliminate the sources of high risk and replace them with a lower-risk alternatives
  - The selection and implementation of alternative activities or products without, or with lower, risk to replace the riskier activities or products
  - These alternatives may eliminate or reduce the impact if the risk occurs

Alternative Approaches

- Risk analysis and mitigation involves the investigation and implementation of alternative approaches which may include:
  - Technical
    - Example: substitute COTS products, relax requirements
  - Management
    - Example: reassign tasks, augment teams
  - Programmatic
    - Example: manipulate schedules, reduce documentation, increase budgets

Industry Best Practices

- Implementing industry best practices within organizations and executing them on projects can drastically reduce risks and issues
- Best practices include technical and programmatic processes and procedures

By doing this organizations will go a long way in reducing risk and issues

SEI CMMI

- Software Engineering Institute (SEI) Capability Maturity Model Integration (CMMI)
  - CMMI for Development v1.2– For suppliers developing/supplying
    - Software
    - Hardware
    - Systems
    - Commercial of the Shelf (COTS)
  - CMMI for Acquisition v1.2
    - For customers acquiring systems, products and services
  - CMMI for Service v1.2
    - For organizations providing services

All these CMMIs have process areas for most activities associated with program/project development and acquisition

Their proper implementation would result in best practices

SEI CMMI

CMMI Process Areas for CMMI for Development v1.2

Level	Process Areas
5 - Optimizing	Organizational Innovation and Deployment Causal Analysis and Resolution
4 - Quantitative Managed	Organizational Process Performance Quantitative Project Management
3 - Defined	Requirements Development Technical Solution Product Integration Verification Validation Organizational Process Focus Organizational Process Definition Organizational Training Integrated Project Management Risk Management Decision Analysis and Resolution
2 - Managed	Requirements Management Project Planning Project Monitoring and Control Supplier Agreement Management Measurement and Analysis Process and Product Quality Assurance Configuration Management
1 - Initial Competent people and heroics, sometimes ad hoc ***(Subject to high incidence of RISKS)***	

SEI CMMI

The CMMI is itself a Risk Management Plan

Managing Risks, Methods for Software Systems Development; Dr. Elaine M. Hall, SEI Series in Software Engineering

Other Frameworks

- Other Methodologies/Frameworks
  - 6 Sigma
    - Process Improvement
    - Reduce variation
    - Statistical/quantitative
  - Lean 6 Sigma
    - Process Improvement
    - Reduce Waste
    - Less statistically rigorous then 6 sigma
  - ITIL – Information Technology Infrastructure Library
    - For Information Technology
    - Services Focused

Other Frameworks

– ISO 9000 standards

- ISO 9001 - applies to companies required to design, develop, produce, install, service and supply a product or service
- ISO 9002 - applies to companies required to produce, install, service and supply a product or service according to an existing design
- ISO 9003 - addresses only the requirements for detection and control of problems during final inspection and testing

– Others

Reducing Risks with the Proper Specification of Requirements

The next presentation was published as a paper in Crosstalk, The Journal of Defense Software Engineering, April 2002 by Al Florence
Title of the publication:

RISKY Requirements

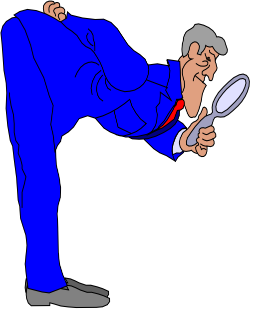
It also received an award in the best paper competition at MITRE

December 17, 2008 — Computerworld —
Melinda-Carol Ballou, an analyst with IDC in Framingham, Mass., said that 70% to 80% of IT project failures relate directly to poor requirements gathering, management and analysis.

And specification – Al Florence

Proper Specification of Requirements

- A government agency, while modernizing their information systems, reverse-engineered requirements
- With domain knowledge of the application, several teams were involved
  - They represented
    - Users
    - Contractors
    - Acquisition organization
- This author was assigned as a consultant to guide the teams in the proper specification of requirements
- The examples presented show some of the requirements:
  - As initially specified by the teams
  - Next a critique of the requirements by this author
  - Finally the re-specified requirements based on the critique



Criteria for Specifying a Good Requirement

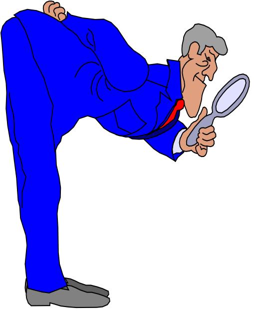
The following are some critical attributes that requirements must adhere to: *(Used to critique requirements)*

- Completeness: Requirements should be complete

  They should reflect system objectives and specify the relationship between the software and the rest of the subsystems

- Consistency: Requirements must be consistent with each other; no requirement should conflict with any other requirement

  Requirements should be checked by examining all requirements in relation to each other for consistency and compatibility



Criteria for Specifying a Good Requirement

- Traceability: Each requirement must be traceable to some higher-level source, such as a system level requirement

  Each requirement should also be traced to lower level design and test abstractions such as high-level and detailed-level design and test cases

- Testability: All requirements must be testable in order to demonstrate that the software end product satisfies its requirements

  In order for requirements to be testable they must be specific, unambiguous, and quantitative whenever possible. Avoid negative, vague and general statements

Criteria for Specifying a Good Requirement

- Feasibility: Each requirement must be feasible to implement

  Requirements that have questionable feasibility should be analyzed during requirements analysis to prove their feasibility

- Unique identification: Uniquely identifying each requirement is essential if requirements are to be traceable and testable

  Uniqueness also helps in stating requirements in a clear and consistent fashion

Criteria for Specifying a Good Requirement

- Design Free: Software requirements should be specified at a requirements level not at a design level

  The approach should be to describe the software requirement functionally from a system (external) point of view, not from a software design point-of-view, i.e. describe the system functions that the software must satisfy. Some requirements may have design embedded due to constraints placed on them by the system, interfaces or legacy

- Use of "shall" and related words: In specifications, the use of the word "shall" indicates a binding provision

  Binding provisions must be implemented by users of specifications. To state non-binding provisions, use "should" or "may". Use "will" to express a declaration of purpose (e.g., "The Government will furnish..."), or to express future tense. MIL-STDs

Note: Methods other that the use of "shall" can be used to specify requirements such as using a matrix with a column for requirements and another column for comments or italics or underlines for comments.

Example 1

- Initial specification

  The Financial Agent sends to the government by 6:00 PM ET on the same day after receipt of the file CRDF that includes only critical data collected from the enrolled individual.

- Critique
  - No unique identifier provided
  - The word “shall” is missing
  - How is the file sent?
  - Has design implications: “CRDF”
    - Should define data, not name of data file - this should be done in the design
  - The critical data has to be identified

Example 1

- Re-specification

  3.3.1.3 The Financial Agent shall send the government, via electronic transmission, the following critical data collected from each enrolled individuals by 6:00 PM ET on the day of receipt:

  a. Name

  b. Address

  c. Zip Code

  d. Social Security Number

Example 2

- Initial specification:

  3.2.5.7 The system shall process two new fields (provides production count balancing info to states) at the end-of-state record
- Critique:
  - This requirement cannot be implemented or tested.
  - It is incomplete. What are the two new fields?
  - "Info" should be spelled out
- Re-specification:

  3.2.5.7 The system shall provide the following data items (provides production count balancing information to states) at the end-of-state record:

  a. SDATE, and

  b. YR-TO-DATE-COUNT

Example 2

- Re-Critique:
  - This rewrite has design implications SDATE record and YR-TO-DATE-COUNT
    - From a requirements viewpoint it should specify what the data in the records are, not the name of the record as it exists in the design and implementation
- Re-Re-Specification:

3.2.5.7 The system shall provide the following data items (provides production count balancing information to states) at the end-of-state record:

a. Submission date and time

b. Year-to-date totals

Example 3

- Initial specification:

  3.2.5.9 All computer-resident information that is sensitive shall have system access controls. Access controls shall be consistent with the information being protected and the computer system hosting the data.

- Critique:
  - Two “shalls” under one identifier
  - The requirement is vague and incomplete. Need to identify the sensitive information.
  - What does “consistent” mean?
  - As specified it cannot be implemented or tested
- Re-specification:

  3.2.5.9 All sensitive computer-resident information shall have system access controls, consistent with the level of protection. (Reference Sensitive Information, Table 5.4.1 and Level of Protection for Sensitive Information, Table 5.4.2)

Example 4

- Initial specification:

  Software will not be loaded from unknown sources onto the system without first having the software tested and approved

- Critique:
  - If it is tested and approved, can it be loaded from unknown sources?
  - If the source is known, can it be loaded without being tested and approved?
  - Requirement is ambiguous and stated as a negative requirement, which makes it difficult to implement and test
  - A unique identifier is not provided, which makes it difficult to trace
  - The word “shall” is missing

Example 4

- Re-specification:

  3.2.5.2 Software shall be loaded onto the operational system only after it has been tested and approved

Example 5

- Initial specification:

  3.2.7.1 The system shall purge state control records and files that are older than the operator or technical user-specified retention period

- Critique:
  - Requirement is incomplete and vague without specifying the retention period or providing a reference as to where the information can be obtained
  - Requirement cannot be implemented or tested as stated

- Re-specification:

  3.2.7.1 The system shall purge state control records and files that are older than the retention period input into the system by either the

    a. operator, or

    b. technical user

Example 6

- Initial specification:

  3.3.2.1 The system shall have no single point failures

- Critique:
  - This is an ambiguous requirement. Needs identification of what components and/or functions the “no single point failures” applies to
  - As specified it cannot be implemented or tested
- Re-specification:

  3.3.2.1 The following system components shall have no single point failures:

  a. Host servers
  b. Networks
  c. Network routers
  d. Access servers
  e. Hubs
  f. Switches
  g. Firewalls
  h. Storage devices

Example 7

- Initial specification:

  3.2.6.3 The system shall receive and process state return data from the State Processing Subsystem. The system shall provide maintenance of the state data files and generate various reports.

- Critique:
  - Two “shalls” under one requirement number and multiple requirements in the specification
  - The word “process” in the first shall is vague; need to define the processing required
  - The second “shall” does not provide for valid requirements; they cannot be implemented or tested as stated
    - Needs identification of type/amount of maintenance required
    - “various reports” is ambiguous

Example 7

- Re-specification:

  3.2.6.3 The system shall receive:

  a. production data that contains data from multiple states, and

  b. state total amount for one or more states,

  extracted by the Returns Processing Subsystem.

  3.2.6.4 The system shall parse multi-state data to respective state files

  3.2.6.5 The system shall display a summary screen reporting the results of processing for each state containing:

  a. state totals,

  b. state generic totals, and

  c. state unformatted totals.

Example 8

- Initial specification:

  3.2.9.1 When doing calculations the software shall produce correct results.

- Critique:
  - Really? This is not a requirement.
  - This type of non-requirements should not be specified!
  - It should be deleted.
- Re-specification:

  Requirement deleted.

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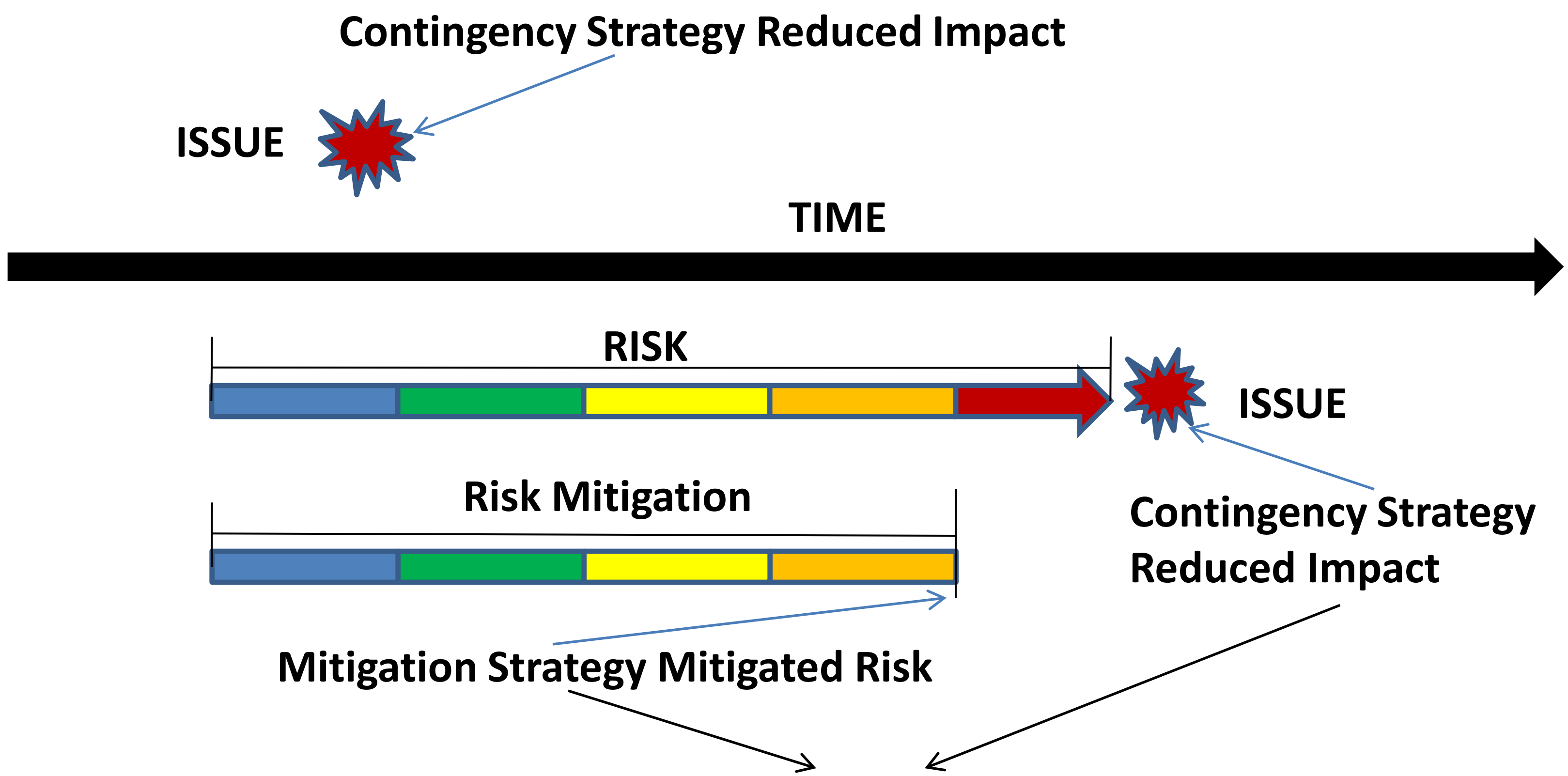
Risk/Issue Opportunity

- An Opportunity is a *potential* event which, if *taken advantage* of, will *positively affects* the ability of the project or program to meet its objectives
  - Opportunities to improve project performance may surface while applying mitigation or contingency strategies
  - The mitigation or contingency strategies could be used as best practices on the project or other projects to keep the risk from recurring

Risk / Opportunity

- An opportunity may be the potential of improving the value of project results; the project itself is the paramount opportunity
- A risk is the potential of not achieving the project strategic opportunity
- Taking risks can lead to opportunities but risk taking can itself be quite risky unless the risk is well thought out and well managed

Capturing Lesson Learned in Support of Opportunities



Stored in lessons learned database which can be documented as a best practice opportunity to be reused on this or other projects to keep the risk or issue from recurring ***(Hopefully Identified and corrected Root Cause) (Also Called Process Improvement)***

Real Project Example

- Opportunity
  - Galileo Space Probe to Jupiter to investigate the Jovian atmosphere and gather scientific information
- A Risk
  - Voyager Space Craft on flyby of Jupiter discovered high radiation, which destroys electrical components, and high incidences of cosmic ray events, which flips volatile computer bits
  - IF the Galileo Probe is not designed to protected against this phenomena prior to launch
  - THEN the microprocessor may fail before the mission is accomplished resulting in less science collected or complete mission failure
- A mitigation strategy was developed and deployed
  - Redesign the configuration of the probe to protect volatile bits and electronic components
- Issue
  - Did not materialize
- Opportunities
  - Galileo Probe was successful and accomplished its full mission
  - Lessons learned were used on other space missions

Real Project Example

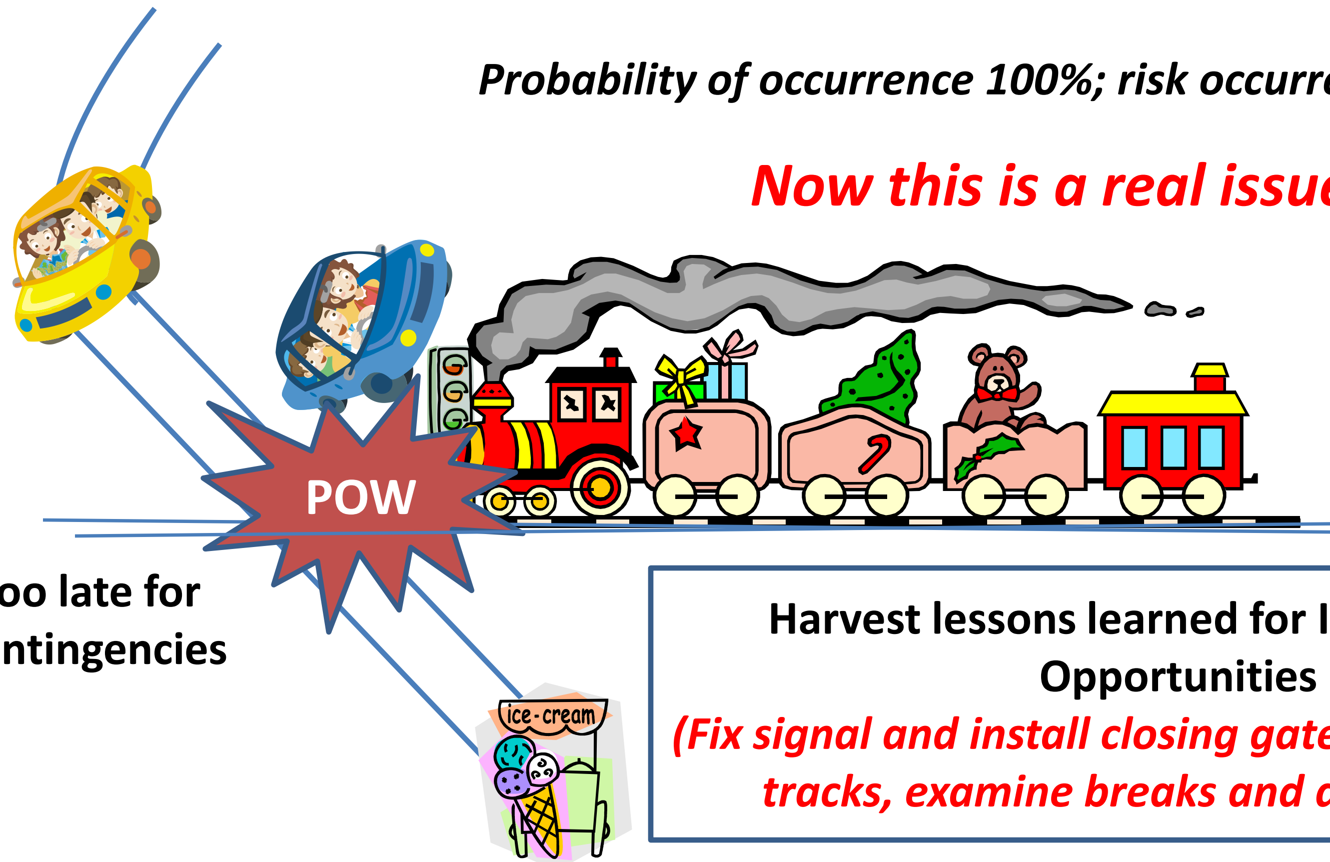
- Mitigation
  - Initial design had one microprocessor to command and control the instruments, collect scientific data and telemeter to orbiter
  - Eliminate 2 experiments and install 2nd microprocessor
    - Both redundantly collecting same data and sending to orbiter
    - Place processors in the center of probe
  - Provide for redundant triple collection and triple voting on both processors on critical parameters such as timing
  - Hopefully when one processor destroyed the other may continue to operate

This mitigation (redesign) extended the life of science gathering until probe implosion

Issue/Opportunity

Probability of occurrence 100%; risk occurred

Now this is a real issue!



Too late for Contingencies

Harvest lessons learned for Improvement Opportunities
(Fix signal and install closing gates on both sides of tracks, examine breaks and doors on cars)

The good news is that no one was hurt, obviously this is a toy train and toy cars

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References

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- *The Black Swan: The Impact of the Highly Improbabl*e; Nazism Nicholas Tale ; The Random House Publishing Company
- http://pascal.computer.org/sev_display/index.action SEVOCAB: Software and Systems Engineering Vocabulary

Contact Information

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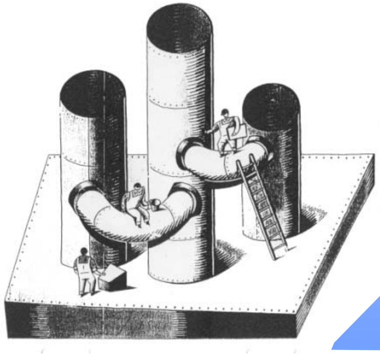
NCOIC™'s
Network Centric Analysis Tool
(NCAT ™)
Overview
&
Tutorial Demonstration

Todd Schneider
Chair – NCA Content WG

25 October 2010

Approved for Public release
Distribution Unlimited
NCOIC-NCAT Overview 20101025

Net-Enabled Future



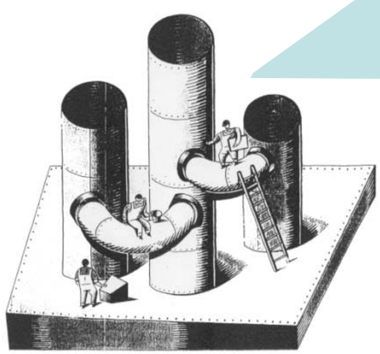
Stove-piped Systems, Point-to-Point Networks

Vision

Industry working together with our customers to provide a network centric environment where all classes of information systems interoperate by integrating existing and emerging open standards into a common evolving global framework that employs a common set of principles and processes.

Net-Enabled Future

Today: Stovepiped Systems, Point-to-Point Networks



Mission

Our mission is to facilitate the global realization of Network Centric Operations. We seek to enable interoperability across the spectrum of joint, interagency, intergovernmental, and multinational industrial and commercial operations. NCOIC is global, with membership open to those who wish to apply the vast potential of network centric technology to the operational challenges faced by our nations and their citizens.

Network Centric Operations Industry Consortium

NCOIC is a Unique Organization

NCOIC exists to facilitate the global realization of Network Centric Operations/Net Enabled Capability. We seek to enable interoperability across joint, interagency, intergovernmental, and multinational industrial and commercial operations.

- Global Organization
- Voice of industry
- Cadre of technical experts
- Dedicated to interoperability
- Advisory Council of senior advisors who help prioritize our work in a non-competitive environment

In the photo: BrigGen Dieter Dammjacob (DEU AF)-J3 NATO Supreme Headquarters, Allied Powers Europe; Lt.Col. Danut Tiganus-CIS Directorate, EU Military Staff; Dr. Tom Buckman-NC3A Chief Architect; Gen Harald Kujat,-German AF (Ret.) former Chief of Staff of German Armed Forces & head of NATO Military Committee, Marcel Staicu-European Defense Agency NEC Project Officer .

NCOIC Members

- 80+ Member Organizations including leading IT and Aerospace & Defense companies, government organizations, non-governmental organizations and academic institutions
- Members from 18 Countries
- Advisors from 26 key stakeholders from Australia, EDA, France, Germany, Italy, NATO, The Netherlands, Sweden, UK and US

Working Group collaboration

Executive and Advisory Council joint meeting

Technical Council

Terry Morgan honors outgoing Advisory Council Chair, Keith Hall

Collaboration

- NCOIC facilitates interoperability by collaboration
  - Member organizations & Advisory Council
  - Our member's customers
  - Agencies of global governments
  - Other NCO stakeholders

- Collaboration occurs through
  - Invited Review of developing documents & architectures
  - Joint demonstrations and white papers
  - Joint and hosted forums, symposia and workshops
  - Joint technical development with stakeholders
  - LOI, LOA, MOU, CRADA and other agreements

Photo and screen captures from member lab interoperability demonstration, Rome, May 2010

NCOIC provides guidance for network centric standards and their patterns of use.

Global Stakeholders

Members develop a SCOPE workshop for Australian Department of Defence with Rapid Prototyping Development & Evaluation organization

CDR Fred van Ettinger, (NLD N) C2 Centre of Excellence, signs Letter of Agreement with NCOIC

Members speak with Carlo Magrassi, European Defence Agency Deputy Chief Executive for Strategy

- “The Australian Department of Defence is a keen supporter of NCOIC, its principles and tools. We aim to apply NCOIC’s products to our acquisition process to better define interoperability requirements and improve through-life systems integration prospects.” **John McGarry, Australian Air Commodore.**
- "We have used NCOIC’s NCAT tool to assess levels of interoperability during NATO Response Force exercises. Our Centre of Excellence found the tool to be very useful in establishing the level of interoperability." **Commander Fred van Ettinger, Section Head of the Multi National Command and Control Centre of Excellence.**
- “NCOIC has four characteristics which make it unique. The organization is solely dedicated to network-centric operations and interoperability; its membership stimulates discussions about global interoperability; it serves as a ‘vendor neutral’ forum, and it has a cadre of industry’s top technical experts who are available to do its work.” **Jack Zavin, U.S. Office of the Assistant Secretary of Defense, Networks and Information Integration.**

Relationships

- **Government**
  - Australia Defence Organization (ADO)
  - Eurocontrol
  - European Defence Agency
  - NATO
    - ACT
    - NC3A
    - NCSA
  - Netherlands Command & Control Centre of Excellence
  - Sweden Civil Aviation Authority (LFV)
  - Sweden Defence Materiel Administration (FMV)
  - US Defense Information Systems Agency (DISA)
  - US Department of Homeland Security (DHS)
  - US Federal Aviation Administration (FAA)
  - US Joint Forces Command (JFCOM)
  - US NAVAIR
  - US SPAWAR
  - OSD(NII)
- **Organizational**
  - Australia Defence Information & Electronic Systems Association (ADIESA)
  - NATO Industry Advisory Group (NIAG)
  - OASIS
  - World Wide Consortium for the Grid (W2COG)

2008 IDGA Award:
Outstanding Contribution
to the Advancement
of Network Centric Warfare

NCOIC Key Deliverables

Addressing Inter-Agency, Cross-Industry NCO Gaps

- **Systems, Capabilities, Operations, Programs, & Enterprises (SCOPE) Model**
  - Characterization of commercial, civil, and government requirements for interoperable systems
- **NCOIC Interoperability Framework™ (NIF) and Net Centric Patterns**
  - Recommendations for open standards and their patterns of use to obtain interoperable systems
- **Building Blocks**
  - Catalog of COTS & GOTS open standards based products compliant with NIF recommendations
- **Network Centric Analysis Tool™ (NCAT)**
  - Netcentric analysis of system architectures, including System-of-Systems and Federation of Systems architectures
- **NCOIC Lexicon**
  - A glossary of terms and definitions that lay the foundation for meaningful discussions. Provides a common language for the disparity of ideas concerning key terms, including "NCO."
- **Systems Engineering best practices and processes**
  - These best practices and processes include tools, process and maturity models, modeling techniques, and collaborative environments for NCOIC integration.

These products, combined with NCOIC member expertise in NCO/NEC, measure netcentric capabilities ,requirements, gaps and provide recommendations for interoperability

Sustained Effort to Make NCOIC Products Part of Procurement Process

Overarching Goal: NCOIC deliverables are adopted, utilized and required by customer agencies

Advise — Participate — Adopt — Require

2004/2005 — 2006 — 2008 — 2009 — 2010

Advise

- **All Advisory Council Members**
- **US Defense Science Board**

Participate

- **NATO**
  - C3 IPT
  - NCA FT
- **DISA (US)**
  - CRADA
  - OSWG
  - NCAT
- **OSD-NII (US)**
  - NCAT
  - OSWG
  - Cybersecurity
- **FAA/JPDO (US)**
  - Aviation IPT (NextGen/NEO)

Adopt

- **NATO C2COE NRF**
  - NCAT
- **USAF SPACECOM**
  - NCAT
- **FAA/Eurocontrol**
  - SCOPE/NCAT/Patterns
  - FAA OTA
- **US DoD**
  - Net-Centric Attributes
- **Australian DoD**
  - SCOPE/NCAT
  - Patterns/BBs

Require

- **US DOD/DAU**
- **Aus DoD/RPDE**

NCOIC is Pursuing Plans to Further Increase Influence in Future Procurements

NCOIC Terms

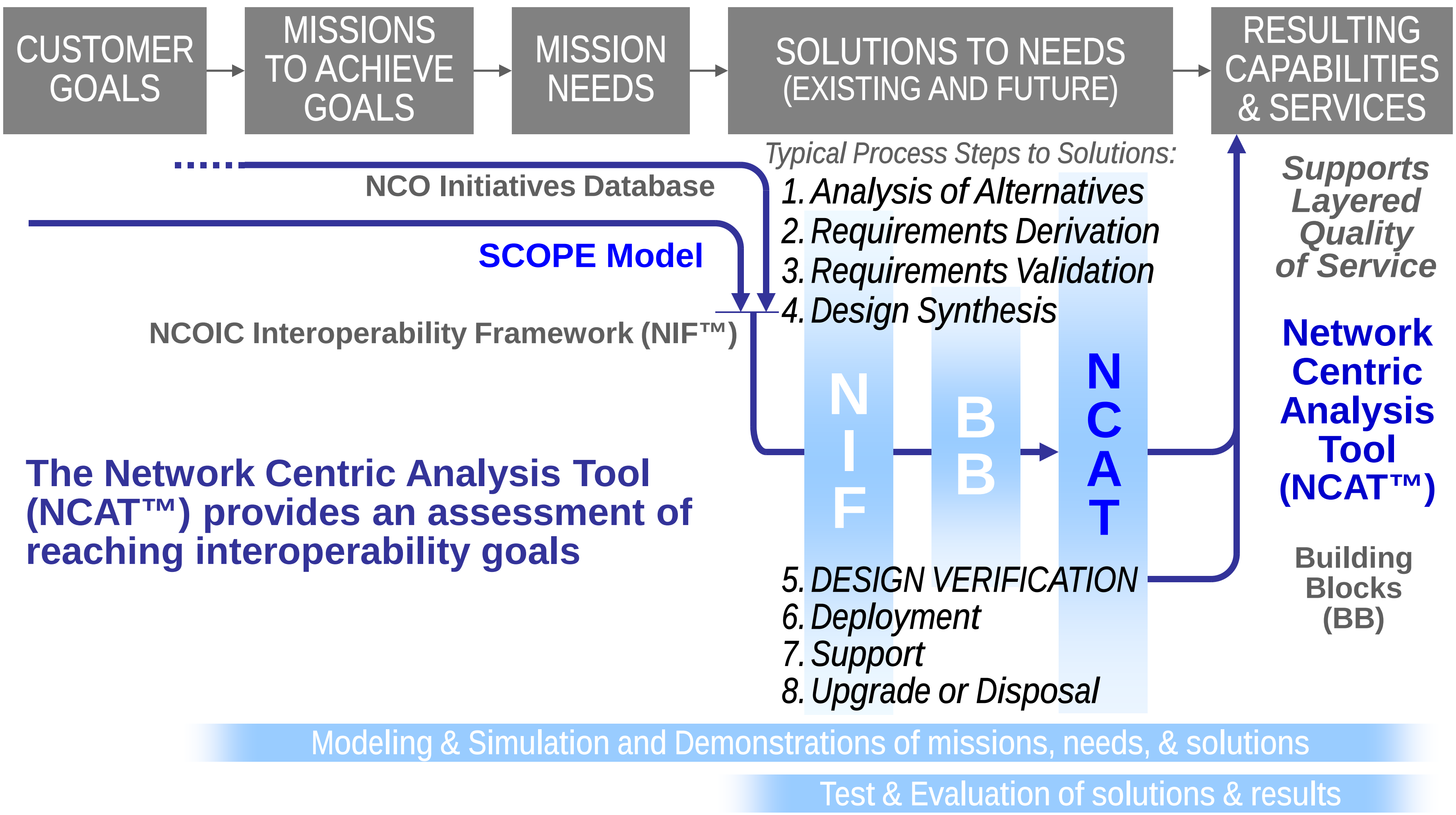
- Network-Centric:
  - Related to systems and patterns of behavior that are influenced significantly or enabled by current and emergent networks and network technologies. Often these center around IP-based internetworking, but the term is sometimes used to include any type of enabling network.
- Network-Centric Operations (NCO):
  - An information superiority-enabled concept of operations that generates increased combat power by networking sensors, decision makers, and shooters to achieve shared awareness, increased speed of command, higher tempo of operations, greater lethality, increased survivability and a greater degree of self-synchronization.

Net-Centricity Requires Interoperability

NCOIC & Interoperability

- (**DOD/NATO**) *The ability of systems, units, or forces to provide services to, and accept services from other systems, units, or forces and to use the services so exchanged to enable them to operate effectively together. (Joint Pub 1-02)*
- **(DOD only)** *The condition achieved among communications-electronics systems or items of communications-electronics equipment when information or services can be exchanged directly and satisfactorily between them and/or their users. The degree of interoperability should be defined when referring to specific cases. (Joint Pub 1-02)*
- (**NATO**) *The ability to operate in synergy in the execution of assigned tasks. (AAP-6 [2005])*
- (**IEEE**) … the ability of two or more systems or components to exchange information and to **use the information that has been exchanged**
- (**Wikipedia**) **Interoperability** is connecting people, data and diverse systems. The term can be **defined in a technical way or in a broad way, taking into account social, political and organizational factors**.

NCOIC Assists Customers
in obtaining interoperable solutions



Network Centric Analysis Tool (NCAT™)

NCAT™

- The NCAT is an assessment tool to…
  - **Provide a metric based approach to evaluating and measuring a system architecture's "fitness" for operating in a net centric environment**
- NCAT focuses on areas of criteria, categories, compliance, and recommendations
  - **Measures how well a target aligns with the areas of compliance**
    - **Criteria and metrics to measure their "goodness" are identified**
  - **Criteria can be grouped together into common categories (e.g. Information Assurance)**
  - **Criteria can be tailored to meet specfic needs**

Network Centric Analysis Tool [NCAT™] Purpose

- **NCAT Supports**
  - Assessing compliance with specific architecture guidelines & ref models
  - Selection of appropriate architectures
  - Comparison between similar entities
  - Implementation of SCOPE analyses
- **NCAT Use Cases**
  - Internal Program performs self-assessment
  - Product Evaluation Engineer ranks similar products based on scoring results
  - Project/program Manager monitors progress comparing planned and achieved behaviors
  - Lead Systems Integrator (LSI) verifies Network Centricity compliance
  - Acquisition Authority selects system/products based on assessment results

Provides confidence that a system can operate in a network centric environment

Who is using NCAT™ ?

- Network Centric Operations Industry Consortium (NCOIC™)
  - Net Enabled Emergency Response (NEER) IPT
  - Sense & Respond Logistics (S&RL) IPT
  - Member companies for new business
- Member companies supporting FAA NextGen
- North Atlantic Treaty Organization (NATO)
- USAF Space Command (via Northrop Grumman)
  - Performing 100+ assessments
- Interest being shown by members of the Australian Department of Defence, DISA and FAA

NCAT Highlights

- Questionnaire-based
- Tailorable Q&As by Program
- Collaborative & Web-enabled
- SQL-driven - Supports MS SQL, IBM DB2 and Oracle database servers
- Excel-to-XML data import & export
- Leverages web services for easy integration with third-party reporting applications
- Supports NCOIC SCOPE model

- Step 1 – Set Goals/ Expectations

- Step 2 – Perform Assessment
- Step 3 – Perform Analysis

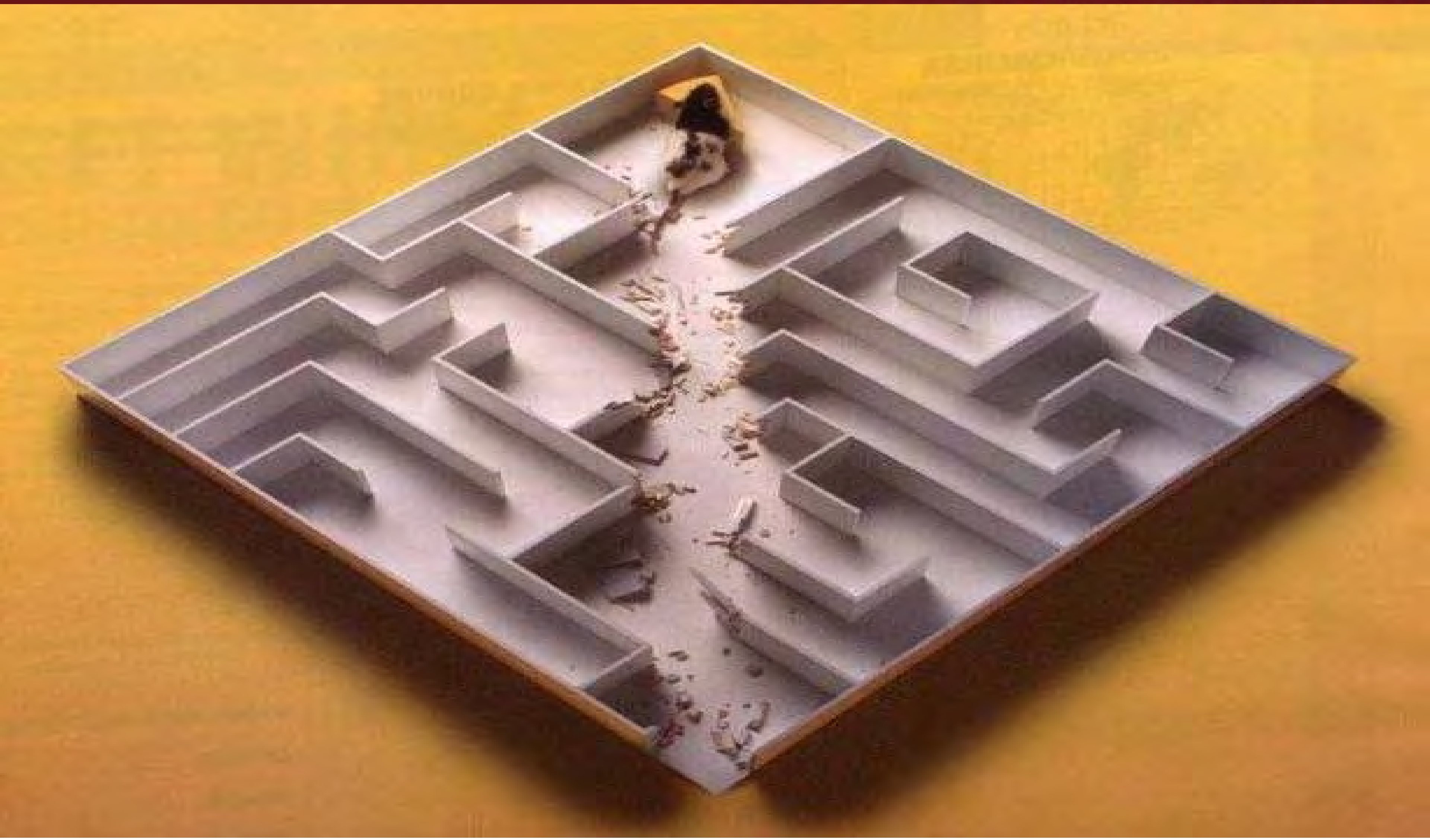
NCAT Terms

- **User attributes** = Roles + Programs
- **Program** (associated with a Survey)
  - Identifies the entity to be assessed
  - Partitions data between programs for privacy
- **Categories**
  - Groups of Questions & Answers
- **Profile** (has a Top Level Category)
  - A tailored set of Questions and Responses grouped by Categories
- **Survey** = Program + (Assess1+Assess2+Assess x)
  - Sets Planned Values
  - Associated with Profile & Program
  - Survey - Aggregation of multiple assessments sharing common Profile for a single program
- **Assessment** = User + Survey
  - Associated with User and Survey
  - Assessment is a single instance – one assessor, one set of questions
- **Reports**
  - Single Assessment or Survey Report with multiple Assessments
  - Compares Planned vs Achieved
  - Export to Excel /other External Analysis Tools

NCAT User Roles

Role	System Administrator	Content Definer	Program Configuration Manager	Assessor	Guest
Explanation	Has technical skills. Has knowledge about Reports and data to import/export.	Defines database content used for surveys and assessments	Administers programs and the surveys within these programs	Performs assessments for specific programs	May receive some general information about what NCAT does - not clearly specified
Associated with Program	**No**	**No**	**Yes**	**Yes**	**No**
NCAT Rights	Can create/edit/delete every NCAT entity such as Users, Programs, Profiles, and Surveys, etc. Can upload or delete Report templates. Can import/export every NCAT entity. Perform assessments. View Reports.	Create/modify/delete Classifications, Questions and Answers. C/m/d Programs and Surveys. Upload or delete Report templates. Perform assessments. View Reports.	Modify/delete ONLY Programs, where the user is assigned with this Role to. Modify/delete Surveys where the user is assigned to the corresponding Program. Perform Assessments for Surveys, where the user is assigned to the corresponding Program. View Reports for those Assessments.	Perform Assessments for Surveys, where the user is assigned to the corresponding Program. View Reports for those Assessments.	No specific rights

Begin with the Goal clearly in mind !



NCAT Demonstration

NCAT - Engine Features

- System
  - Split between tool and content
- Technology
  - Web based **Generic Features**
  - 2 versions using common data base structure
- Access via Web
- Stand-alone on Desktop
  - Database backed
- Functionality
  - Taxonomy based evaluation
  - Multiple users, programs, schemes, profiles, and assessments
  - Response directed assessment
  - Program dependent weights, scales, and priorities
  - Progress tracking (planned, achieved, time series, snapshot)
  - Comparative (systems and phases) analysis
  - Extensive dynamic reporting – compliance, non-compliance, summary, detailed, various formats (tables and graphs)
- Interfaces
  - Import/export XML data

NCAT - Development Background

- **Spiral One**
  - Based on: “Modular Open System Approach – Program Assessment and Rating Tool – DoD (AT&L/DS) - Joint Systems Task Force
  - EXCEL Spreadsheet evaluation via NII Net Centric Checklist
- **Spiral Two**
  - A web based tool
    - Capable of handling multiple sets of criteria
    - Provide extensive reporting
    - Oriented towards design and implementation communities as well as the acquisition community
- **Spiral Three**
  - NCAT content extended to cover all aspects of interoperability:
    - NCOIC SCOPE model
    - NATO Maturity Levels
    - DoD / NATO Net-Ready Key Performance & Interoperability Parameters (NR-KPPs / KIPs)
    - Other customer evaluation criteria

NCAT V3 Enhancements

UI Enhancements

- Sortable tables (each column can be sorted) used in the overview pages, to include Profiles, Programs, Users
- New text fields for editing pages offering better value validation, automatic sizing and calendar widgets
- Improved assessment editing and performance
  - split plane for dragging a border between left/right area of screen
  - using dynamic trees for displaying and modifying categorization
  - popup window for showing contextual information
- Progress bars/wait icons when generating a report
- Value descriptions of question as small popup window

Assessment Enhancements

- Comment fields for each Answer
- Ability to include new attribute for question (example Answer) and displaying it where needed using turn on/off button
- Branching questions using an overview tree for displaying the different branches in editing mode
- Implementing agent for transferring old database content to new database schema

Usability Enhancements

- Excel-to-XML data import/export
- Supports MS SQL, IBM DB2 and Oracle database servers
- Leverages web services for easy integration with third-party reporting applications

Additional Enhancements

- Option to add a keyword list to Profiles and setting a corresponding filter in the Profile view
- Encrypting saved passwords
- Server binds to all available IP-addresses when starting application within enterprise network

NCAT Scenarios

Scenario 1: Product Evaluation Engineer Ranks Products

- Product evaluation engineer runs NCAT on multiple products with a common set of criteria. He produces a comparative report. He then ranks the products based on NCAT scores. Selection of the products guided by the NCAT scores depends on other factors.

Scenario 2: Project/program manager Monitors Progress

- The manager prepares a common set of criteria; runs NCAT at various phases of the project/Program. A comparison of the results shows the progress.

Scenario 3: LSI verifies/assesses compliance

- An LSI engineer/manager, before integrating the vendor products runs NCAT to assure interoperability and integration.

Scenario 4: Quality Check Engineer identifies root causes of failure

- Quality Engineer runs NCAT to determine if the system meets the set criteria. Root causes report is produced to identify and rectify possible failures.

NCAT Scenarios (cont’d)

Scenario 5: Acquire System

- System to be acquired is evaluated with a common set of criteria, which has a minimum level of acceptability. While identifying failure areas, NCAT gives a measure of acceptance/confidence.

Scenario 6: Architect identifies standards

- An engineer in charge of designing a net-centric system or its components creates an architecture with various views (i.e., SVs), that support a Technical View. He then evaluates it using NCAT and produces a guidance report. The report provides recommended applicable standards to improve the component’s Net Centric characteristics.

Scenario 7: Assess system maturity

- A company developing a net-centric system assesses it against a maturity model that defines several levels of net-centric compliance. When compared to customer needs, this gives input to the development plans.

NCAT™ - Methodology

- NCAT™ focuses on compliance assessment using pre-defined questions and multiple choice responses
  - Identifies criteria and metrics to measure “goodness”
  - Measures how well a target aligns with the areas of compliance
  - Groups criteria into common categories like Information Assurance (IA)
- First – define standard against which to measure compliance
- Compliance Level determined by Assessor selecting using multiple choice responses with weighted scores to standard questions
- Assessments structured by an administrator who crafts the questions and planned target results for the specific case.
- Profiles developed by selecting applicable subsets of the available questions or creating new questions and responses
- Assessment Results (individual or series) reported
- Data Privacy maintained and not openly visible

Asking the right people the right questions

What are we measuring?

Network Centric Attributes and Behaviors

Attribute	Description
Internet & World Wide Web Like	Adapting Internet & World Wide Web constructs & standards with enhancements for mobility, surety, and military unique features (e.g. precedence, preemption) .
Secure & available information transport	Encryption initially for core transport backbone; goal is edge to edge; hardened against denial of service.
Information Protection & Surety (built-in trust)	Producer/Publisher marks the info/data for classification and handling; and provides provisions for assuring authenticity, integrity, and non-repudiation.
Post in parallel	Producer/Publisher make info/data visible and accessible without delay so that users get info/data when and how needed (e.g. raw, analyzed, archived).
Smart pull (vice smart push)	Users can find and pull directly, subscribe or use value added services (e.g. discovery). User Defined Operational Picture v Common Operational Picture.
Information/Data centric	Data separate from applications and services. Minimize need for special or proprietary software.
Shared Applications & Services	Users can pull multiple applications to access same data or choose same apps when they need to collaborate. Applications on “desktop” or as a service.
Trusted & Tailored Access	Access to the information transport, info/data, applications & services linked to user’s role, identity & technical capability.
Quality of service	Tailored for information form: voice, still imagery, video/moving imagery, data, and collaboration.

Foundation of Net Centric Tenets
NESI Checklist V 1.0.1 04 Feb 2005

This document is a NESI product.
NESI (Net-Centric Enterprise Solutions for Interoperability) is a collaborative activity between the USN PEO for C4I and Space and the USAF Electronic Systems Center.

Net-Centric Implementation Framework

Part 1: Overview

Part 2: ASD (NII) Checklist Guidance

Part 3: Migration Guidance

Part 4: Node Design Guidance

Part 5: Developers Guidance

Part 6: Acquisition Guidance

V 1.0.1
04 February 2005

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Net-Centric Tenets

- Data Tenets – Data/Application Team
  - Make Data Visible
  - Make Data Accessible
  - Make Data Understandable
  - Make Data Trustable
  - Make Data Interoperable
  - Provide Data Management
  - Be Responsive to User Needs

Net-Centric Tenets

- Information Assurance/Security Tenets – IA Team
  - Net-centric IA posture & Ops Continuity
  - ID management, authentication, privileges
  - Mediate Security Assertions
  - Cross-Security Domains Exchange
  - Encryption
  - Employ Wireless Technologies
  - Others – Integrity, Confidentiality, Intrusion detection & reporting, Audits, Policy Compliance, Certification and Accreditation (C&A)

Net-Centric Tenets

- Service Tenets – Enterprise Services Team
  – Service Oriented Architecture (SOA)
  – Open Architecture
  – Scalability
  – Availability
  – Accommodate Heterogeneity
  – Decentralized Ops & Management
  – Enterprise Service Management (ESM)

Net-Centric Tenets

- Transport Tenets – Transport Team
  - IPv6
  - Packet Switched Infrastructure
  - Layering and Modularity
  - Concurrent Transport of Info Flows
  - Differentiated QoS Management
  - Network / Inter-network Connectivity
  - RF Acquisition
  - Joint Net-Centric Capabilities
  - Ops & Management of Transport & Services

Net-Centric Tenets

- Data Tenets – Data/Application Team
  - Make Data Visible
  - Make Data Accessible
  - Make Data Understandable
  - Make Data Trustable
  - Make Data Interoperable
  - Provide Data Management
  - Be Responsive to User Needs

- Service Tenets – Enterprise Services Team
  - Service Oriented Architecture (SOA)
  - Open Architecture
  - Scalability
  - Availability
  - Accommodate Heterogeneity
  - Decentralized Ops & Management
  - Enterprise Service Management (ESM)

- Information Assurance/Security Tenets – IA Team
  - Net-centric IA posture & Ops Continuity
  - ID management, authentication, privileges
  - Mediate Security Assertions
  - Cross-Security Domains Exchange
  - Encryption and HAIPE
  - Employ Wireless Technologies
  - Others – Integrity, Confidentiality, Intrusion detection & reporting, Audits, Policy Compliance, C&A

- Transport Tenets – Transport Team
  - IPv6
  - Packet Switched Infrastructure
  - Layering and Modularity
  - Concurrent Transport of Info Flows
  - Differentiated QoS Management
  - Network / Inter-network Connectivity
  - RF Acquisition
  - Joint Net-Centric Capabilities
  - Ops & Management of Transport & Services

Put together make up the majority of the questions

NCAT Survey Steps

- **Step 1 – Set Goals/ Expectations**

- Administrator creates a Profile to be used for a specific assessment
  - A Profile - selection of questions applicable to a Program
  - Administrator may adjust scores and weights at this stage
- Administrator creates a Program that has a fixed set of Assessors using “Profiles”
- Administrator creates a Survey from the profile
- Administrator sets threshold levels (called planned values) for each question with inputs from the team of stakeholders

- **Step 2 – Perform Assessment**

- Assessor(s) answer Profile questions in the survey for the artifacts being assessed.

- **Step 3 – Perform Analysis**

- Analysts generate reports on the results
  - Assessment Report includes a comparison between the planned values and the actual assessed values for an individual assessment.
  - Summary Report aggregates and scores the responses of all individual assessments for the program.

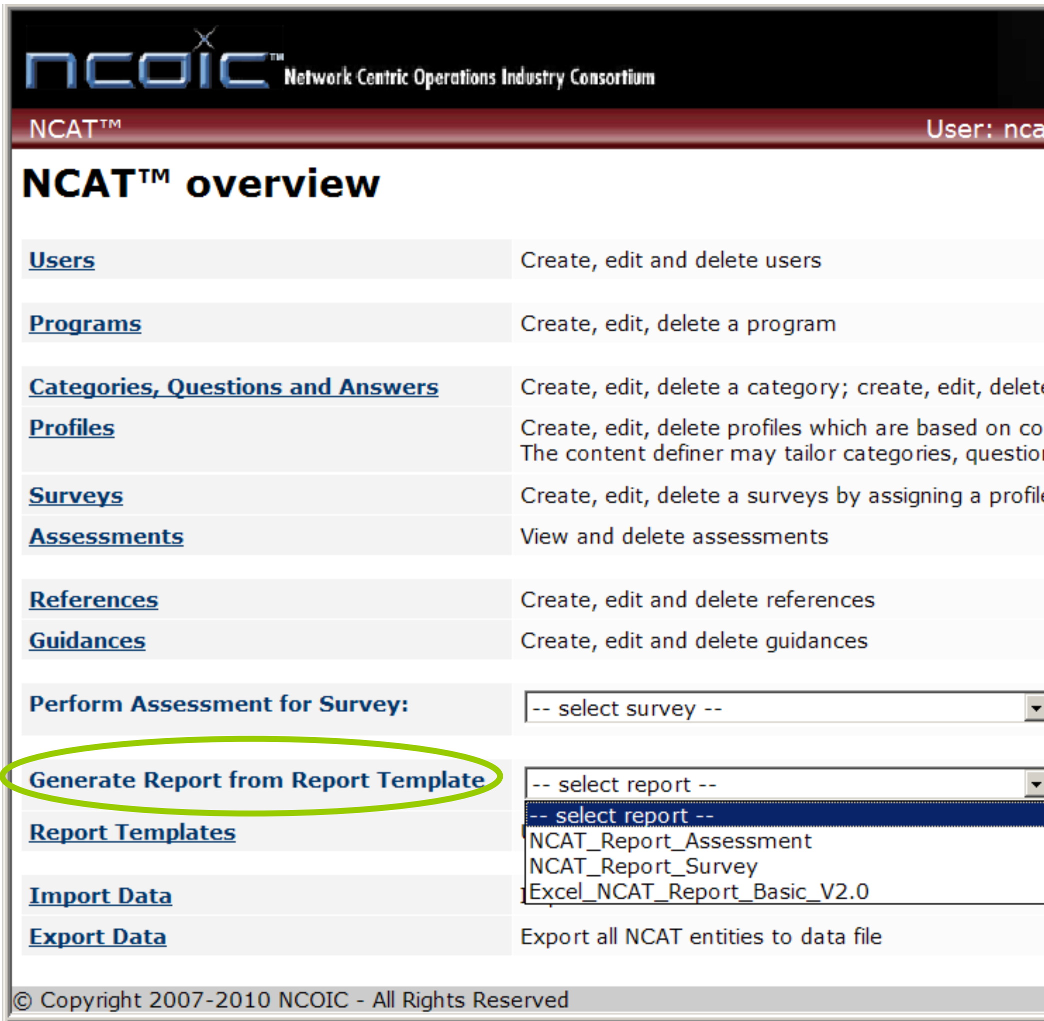
NCAT™ - Measurement Method

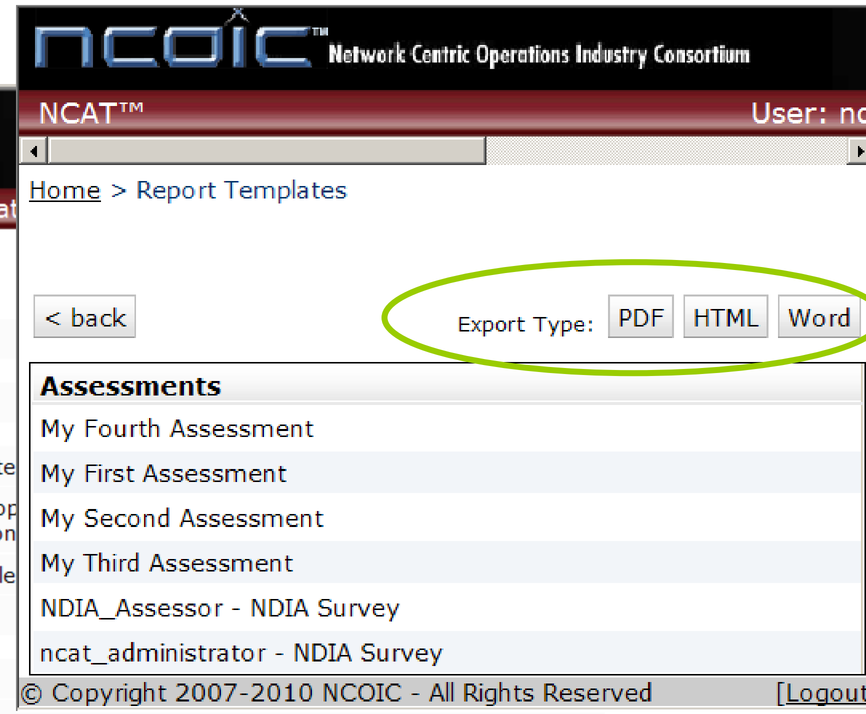
Technologies	Not Implemented	Some Elements	Over half	Most	ALL
Verification/ Certification	NONE	Little or NONE	Little or NONE	Most	ALL
Use of Standards	A Few	A Few More	Some Identified	Most	ALL
Governance Procedures	NONE	NONE	Some Identified	Most	ALL
NON COMPLIANCE 0 %	LOW COMPLIANCE 20%	PARTIAL COMPLIANCE 40%	SOME COMP-LIANCE, NOT ALL 60%	MOSTLY COMPLIANT 80%	FULL COMPLIANCE 100%

NCAT uses a gradient scale

NCAT Assessment Reports

- NCAT Assessment Reports in 3 Formats
  - PDF, HTML, MS Word





NCAT Assessments and Scores

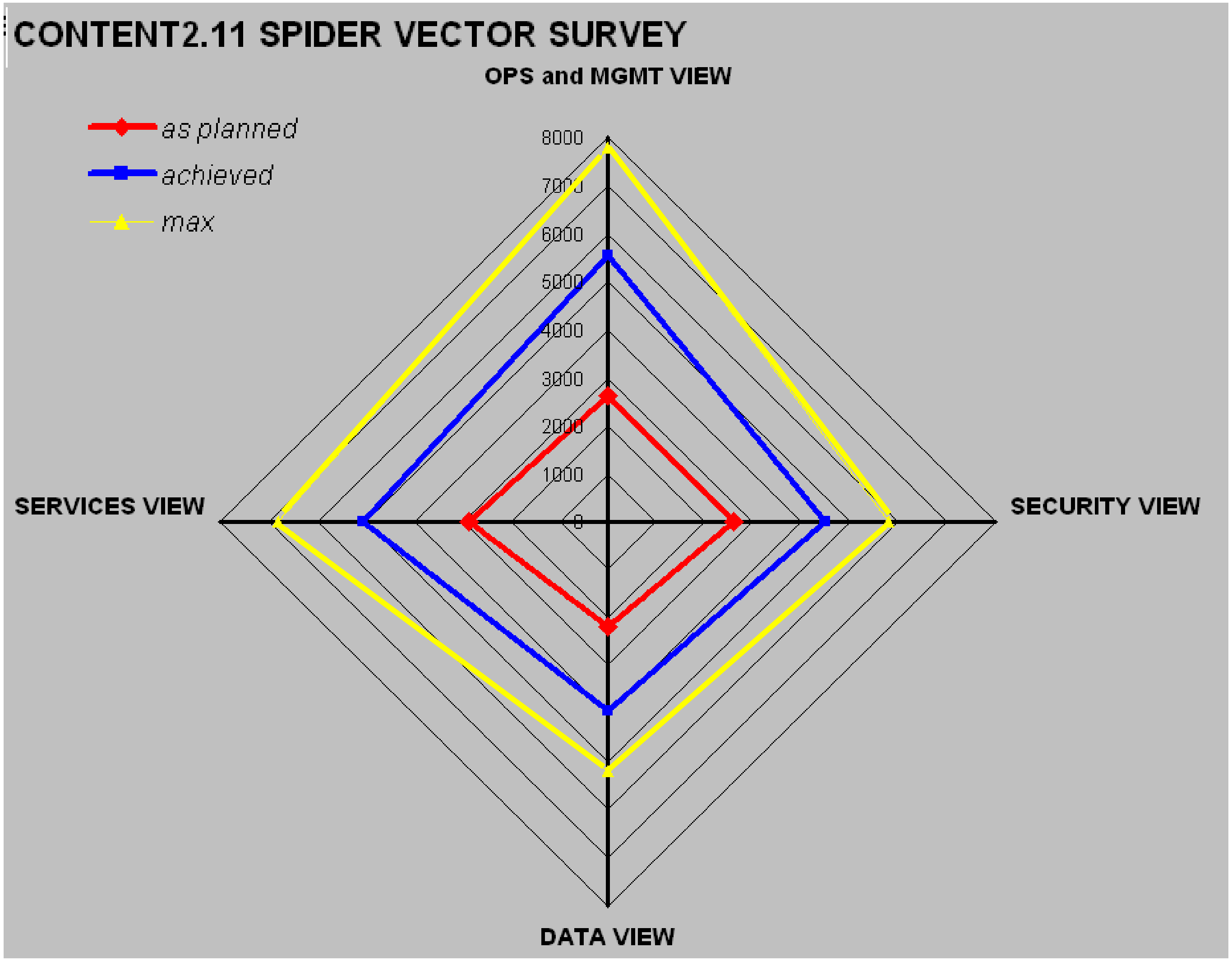
NCAT Tool Provides Overall Assessment and Scores for each Evaluation Criterion

Score Summary

- 25 Total Questions
- Max possible score = 25 x 100 point per question = 2500
- Planned 38.4%
- Achieved 76%
- Does not have to approach max, just meet or exceed planned

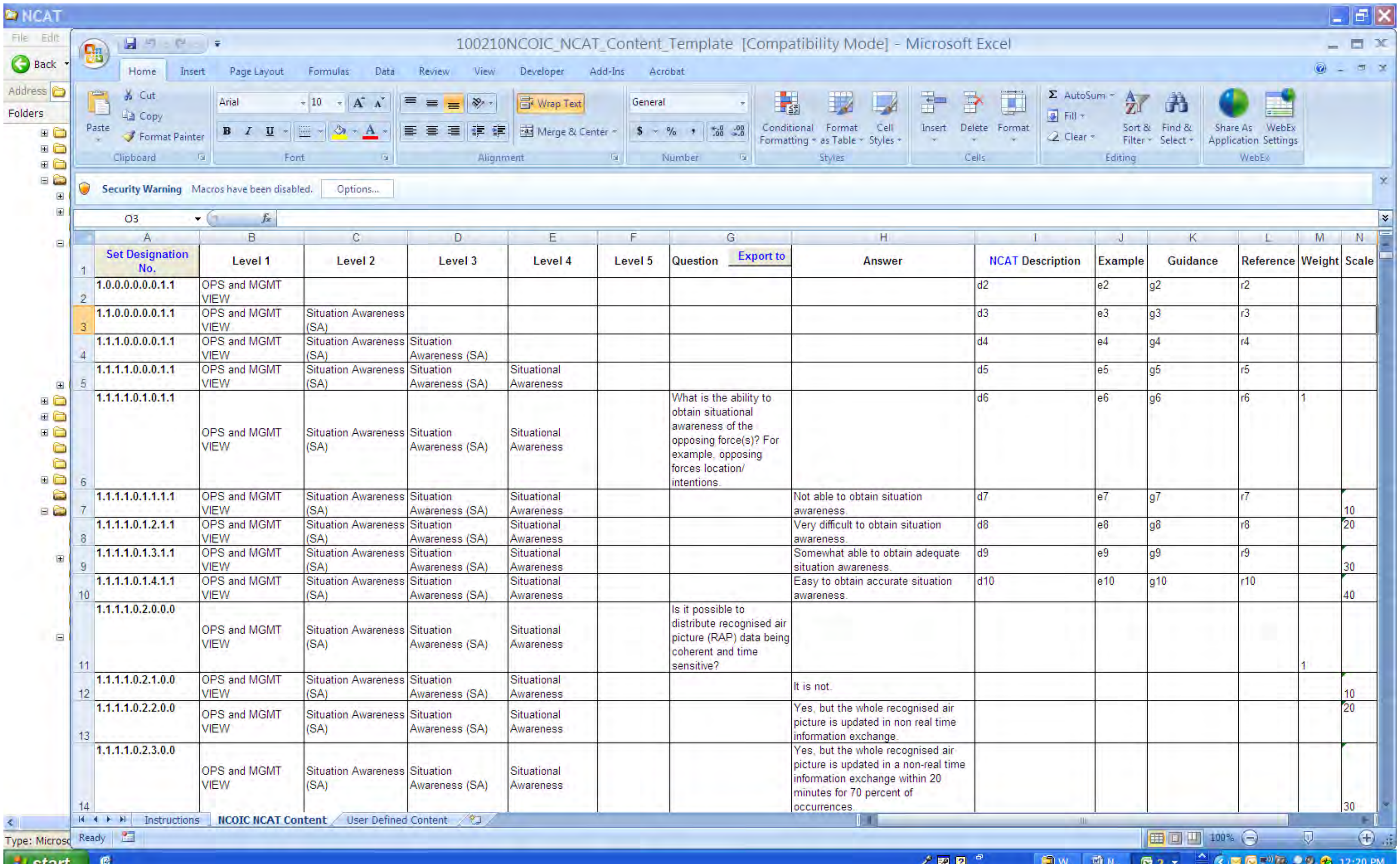
Section	Section	Total Questions Applicable	Total Questions Not Applicable	Max Score		Score	Normalized
A	Service Oriented Architecture	2	0	200	Planned	70	35.00 %
					Achieved	160	80.00 %
B	Open Architecture	7	0	700	Planned	280	40.00 %
					Achieved	660	94.29 %
C	Scalability	5	0	500	Planned	160	32.00 %
					Achieved	300	60.00 %
D	Availability	5	0	500	Planned	180	36.00 %
					Achieved	325	65.00 %
E	Heterogeneity Accommodation	2	0	200	Planned	100	50.00 %
					Achieved	130	65.00 %
F	Enterprise Service Management	4	0	400	Planned	170	42.50 %
					Achieved	325	81.25 %
	Combined Rating	25	0	2500	Planned	960	38.40 %
					Achieved	1900	76.00 %

NCAT™ Content Analysis Example



NCAT Provides Simple Content Import Using Excel

- Enable Macros in Excel
- Follow Instructions on Worksheet 1



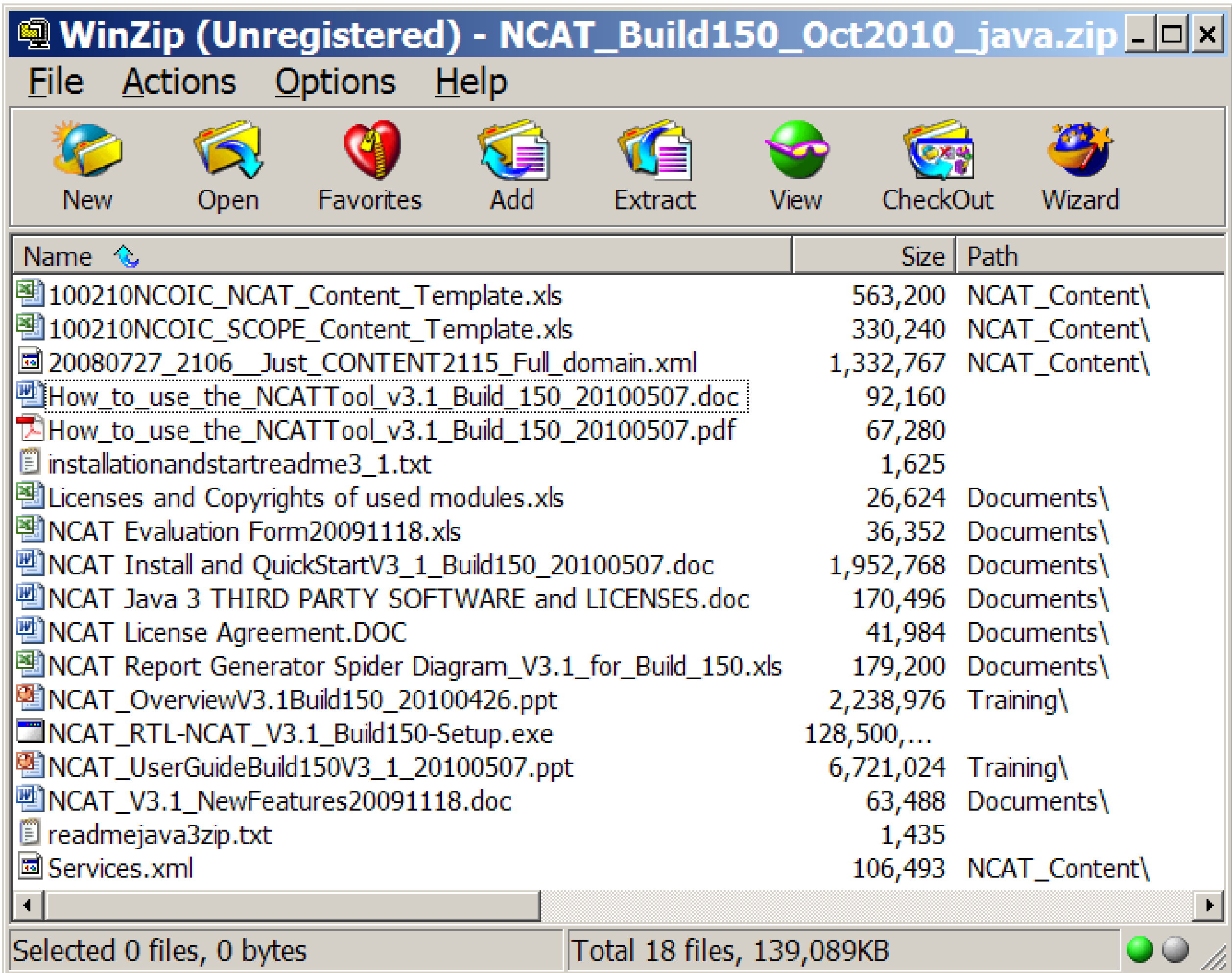
	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Set Designation No.	Level 1	Level 2	Level 3	Level 4	Level 5	Question	Answer	NCAT Description	Example	Guidance	Reference	Weight	Scale
2	1.0.0.0.0.0.0.1.1	OPS and MGMT VIEW							d2	e2	g2	r2		
3	1.1.0.0.0.0.0.1.1	OPS and MGMT VIEW	Situation Awareness (SA)						d3	e3	g3	r3		
4	1.1.1.0.0.0.0.1.1	OPS and MGMT VIEW	Situation Awareness (SA)	Situation Awareness (SA)					d4	e4	g4	r4		
5	1.1.1.1.0.0.0.1.1	OPS and MGMT VIEW	Situation Awareness (SA)	Situation Awareness (SA)	Situational Awareness				d5	e5	g5	r5		
6	1.1.1.1.0.1.0.1.1	OPS and MGMT VIEW	Situation Awareness (SA)	Situation Awareness (SA)	Situational Awareness		What is the ability to obtain situational awareness of the opposing force(s)? For example, opposing forces location/ intentions.		d6	e6	g6	r6	1	
7	1.1.1.1.0.1.1.1.1	OPS and MGMT VIEW	Situation Awareness (SA)	Situation Awareness (SA)	Situational Awareness			Not able to obtain situation awareness.	d7	e7	g7	r7		10
8	1.1.1.1.0.1.2.1.1	OPS and MGMT VIEW	Situation Awareness (SA)	Situation Awareness (SA)	Situational Awareness			Very difficult to obtain situation awareness.	d8	e8	g8	r8		20
9	1.1.1.1.0.1.3.1.1	OPS and MGMT VIEW	Situation Awareness (SA)	Situation Awareness (SA)	Situational Awareness			Somewhat able to obtain adequate situation awareness.	d9	e9	g9	r9		30
10	1.1.1.1.0.1.4.1.1	OPS and MGMT VIEW	Situation Awareness (SA)	Situation Awareness (SA)	Situational Awareness			Easy to obtain accurate situation awareness.	d10	e10	g10	r10		40
11	1.1.1.1.0.2.0.0.0	OPS and MGMT VIEW	Situation Awareness (SA)	Situation Awareness (SA)	Situational Awareness		Is it possible to distribute recognised air picture (RAP) data being coherent and time sensitive?						1	
12	1.1.1.1.0.2.1.0.0	OPS and MGMT VIEW	Situation Awareness (SA)	Situation Awareness (SA)	Situational Awareness			It is not.						10
13	1.1.1.1.0.2.2.0.0	OPS and MGMT VIEW	Situation Awareness (SA)	Situation Awareness (SA)	Situational Awareness			Yes, but the whole recognised air picture is updated in non real time information exchange.						20
14	1.1.1.1.0.2.3.0.0	OPS and MGMT VIEW	Situation Awareness (SA)	Situation Awareness (SA)	Situational Awareness			Yes, but the whole recognised air picture is updated in a non-real time information exchange within 20 minutes for 70 percent of occurrences.						30

NCAT - Engine Features

- System
  - Split between tool and content
- Technology
  - Web based Generic Features
  - 2 versions using common data base structure
- Access via Web
- Stand-alone on Desktop
  - Database backed
- Functionality
  - Taxonomy based evaluation
  - Multiple users, programs, schemes, profiles, and assessments
  - Response directed assessment
  - Program dependent weights, scales, and priorities
  - Progress tracking (planned, achieved, time series, snapshot)
  - Comparative (systems and phases) analysis
  - Extensive dynamic reporting – compliance, non-compliance, summary, detailed, various formats (tables and graphs)
- Interfaces
  - Import/export XML data

NCAT™ Download Link

- Download link for NCAT and related Material
  - http://ncoic.cachefly.net/Java/java.zip



NCOIC eLearning Modules

Network Centric Operations Industry Consortium eLearning Modules

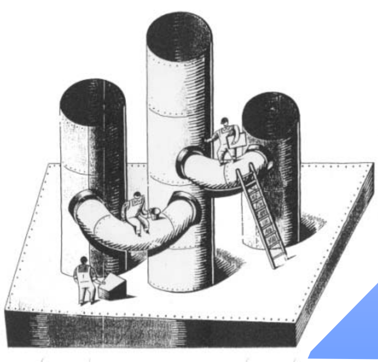
- Network Centric Assessment Tool (NCAT™) Overview
- https://www.ncoic.org/technology/activities/education/elearning/
- Network Centric Operations: The Fundamentals
- The Role of NCOIC Deliverables
- Systems, Capabilities, Operations, Programs, and Enterprises (SCOPE) Model Overview
- NCOIC Interoperability Framework (NIF™) and NCOIC Patterns Overview
- Building Blocks Database Overview
- Export Compliance Overview

On Line Training Materials

Summary

- NCOIC is developing a family of Network Centric Tools for understanding net-centricity and interoperability
- NCOIC provides NCAT to interested stakeholders
- NCAT can be tailored for:
  - Program specific profiles of selected questions
  - comparison of planned vs actual assessments
  - Privacy of program-specific results
- NCOIC requests feedback in return for using NCOIC products.
  - Feedback will be used to improve future versions only.
  - Your feedback will not be shared openly.

Net-Enabled Future



Stove-piped Systems, Point-to-Point Networks

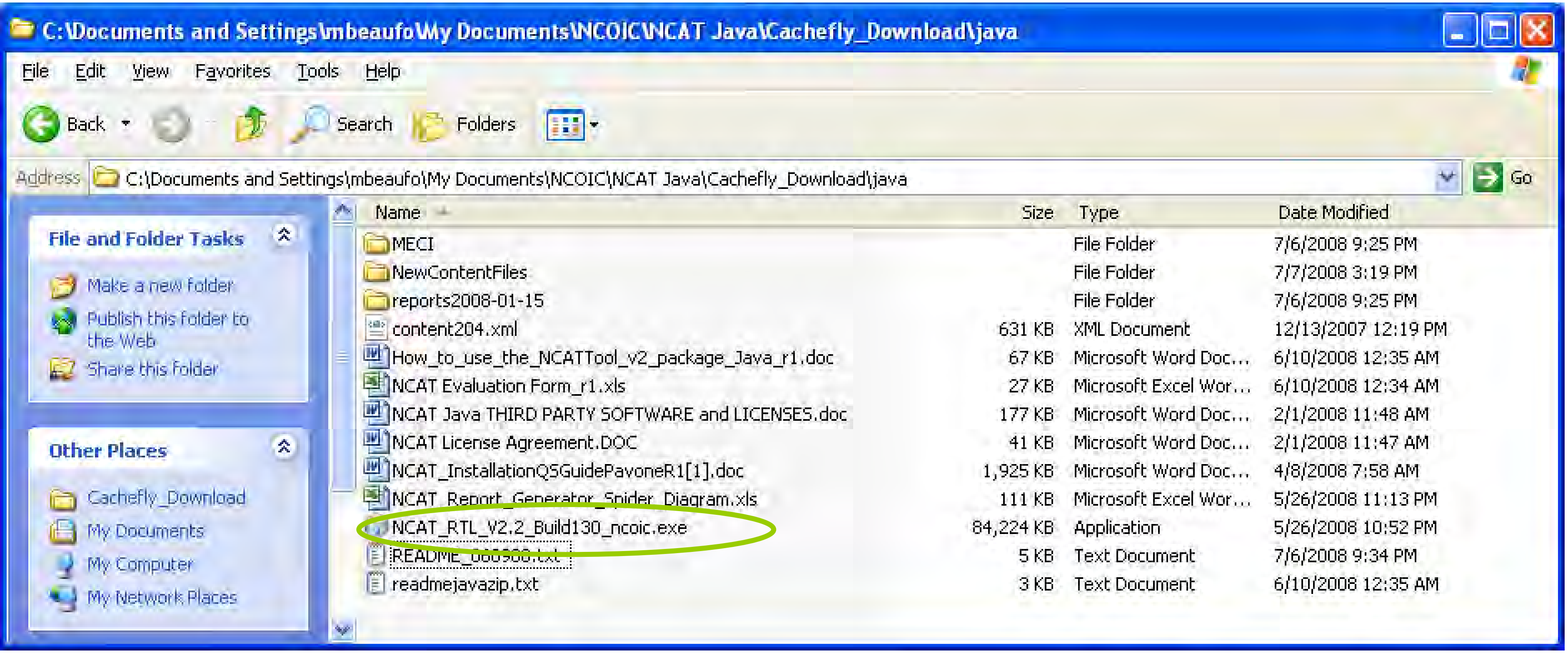
NCAT
Tutorial
Reference

NCAT Engine Tutorial

- In order to better understand NCAT, the following provides a short tutorial on a small subset of the NCAT questions.
  - The subset is entitled “Services” which has 25 questions
- The user will download the Java Zip files and install the NCAT program
- The user will log in as the “ncat_administrator” & do the following:
  - setup a new User Account for “John Q Services” (username “Services”,
  - create a new Program called “Services Program”,
  - create a new Profile called “Services Profile”,
  - create a new Survey called “Services Survey”,
  - set Planned Values, log out
- The user will log in a second time as “Services”:
  - perform the assessment answering 25 questions
  - Run some reports and examine them

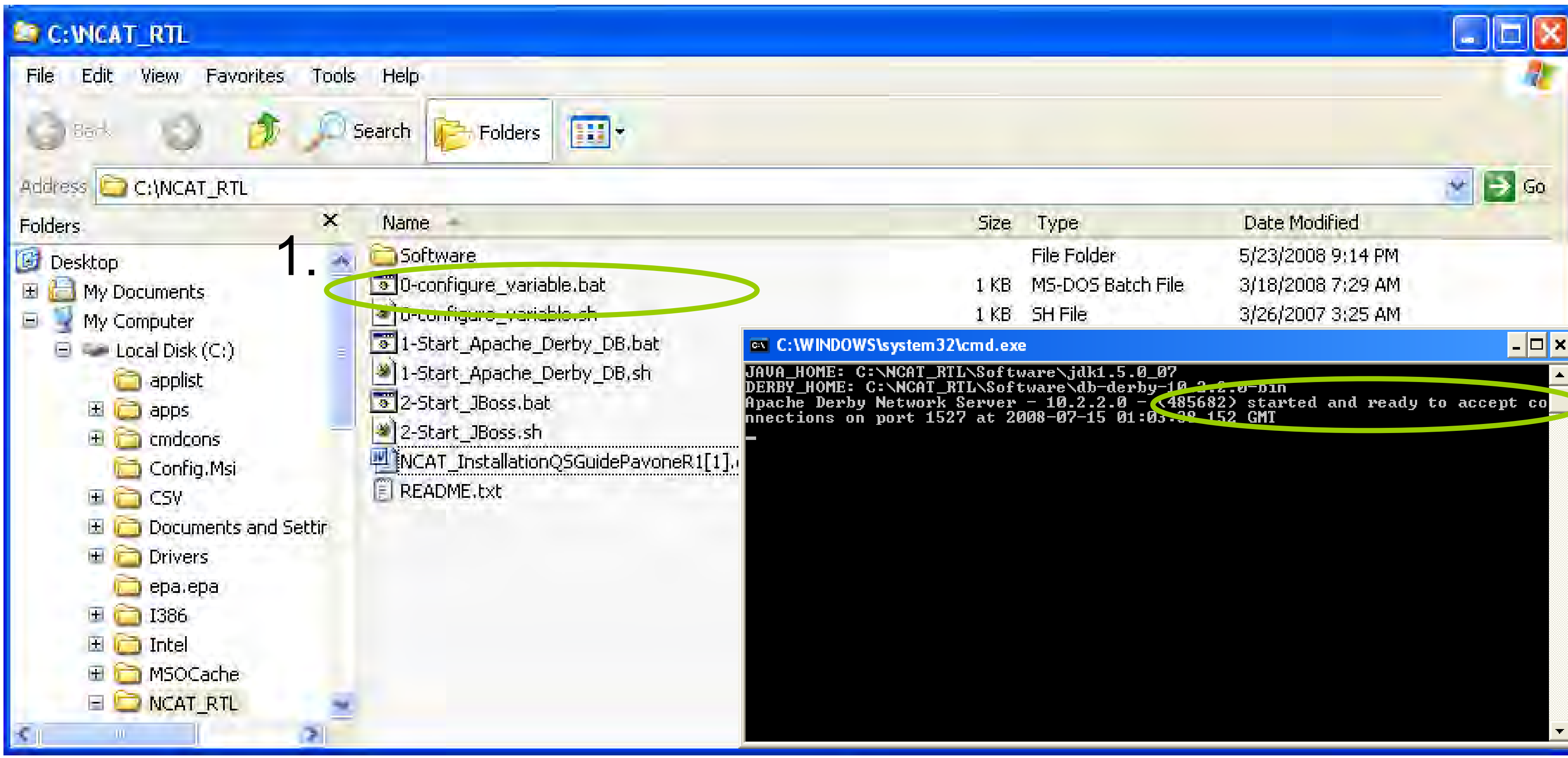
Unzip the files on the host machine

- Double Click on the .exe file to install
- Automatically places files in C:\NCAT_RTL
- Go to C:\NCAT_RTL to start NCAT



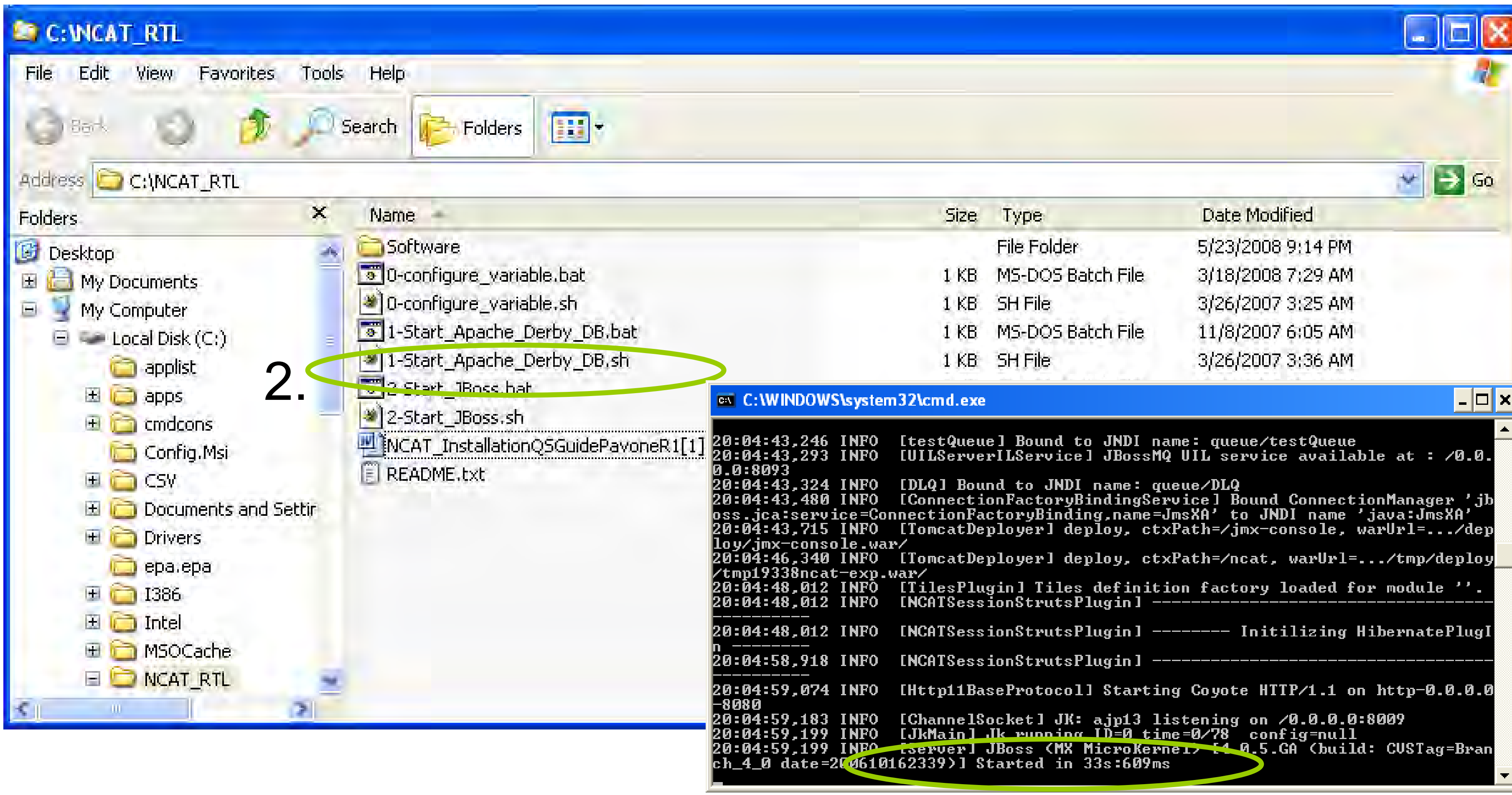
Start NCAT – Derby Database

- 1. Double Click on 1-Start_Apache_Derby_DB.bat
- Wait for the command box to report "started and ready to accept.."

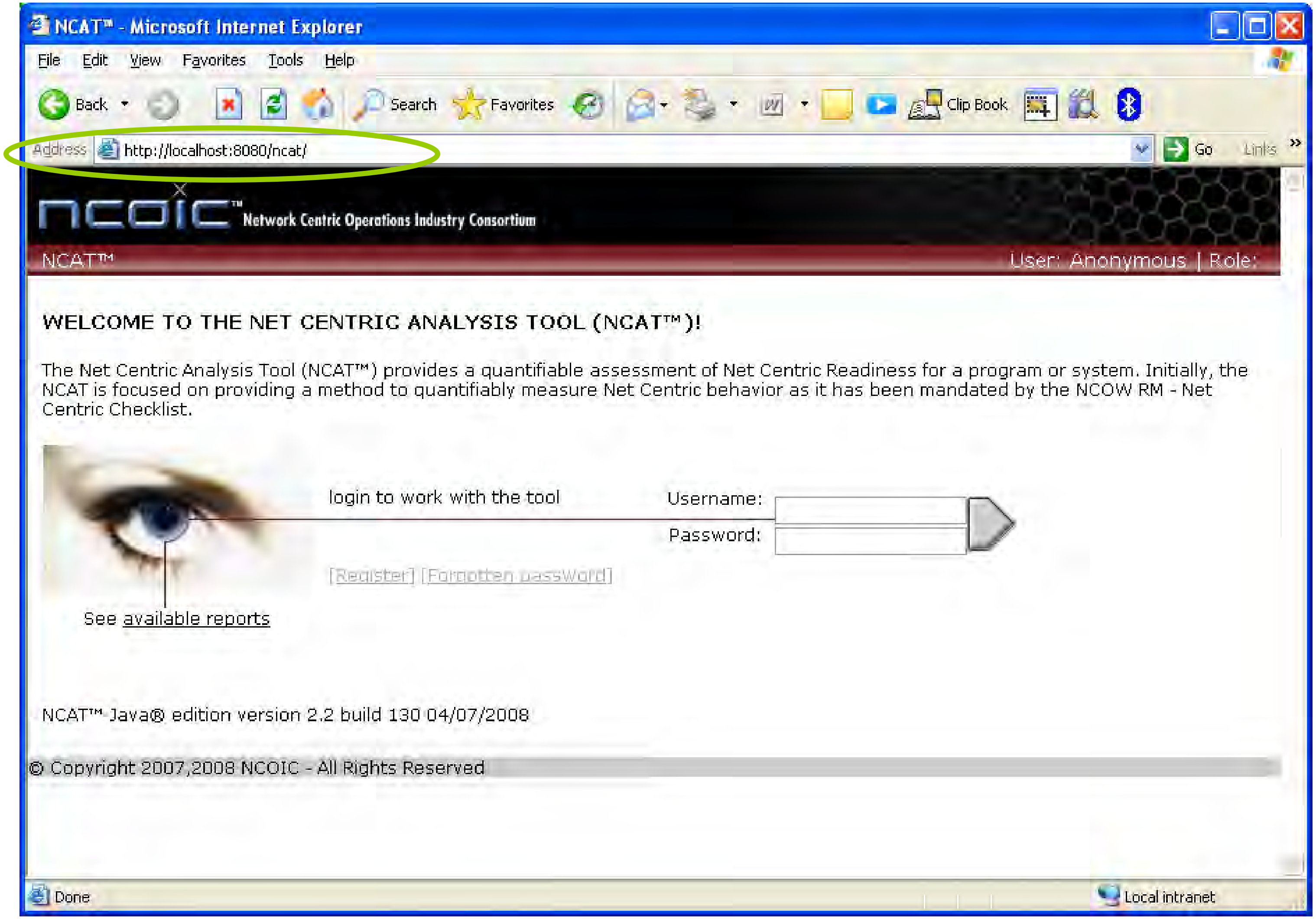


Start NCAT - JBoss

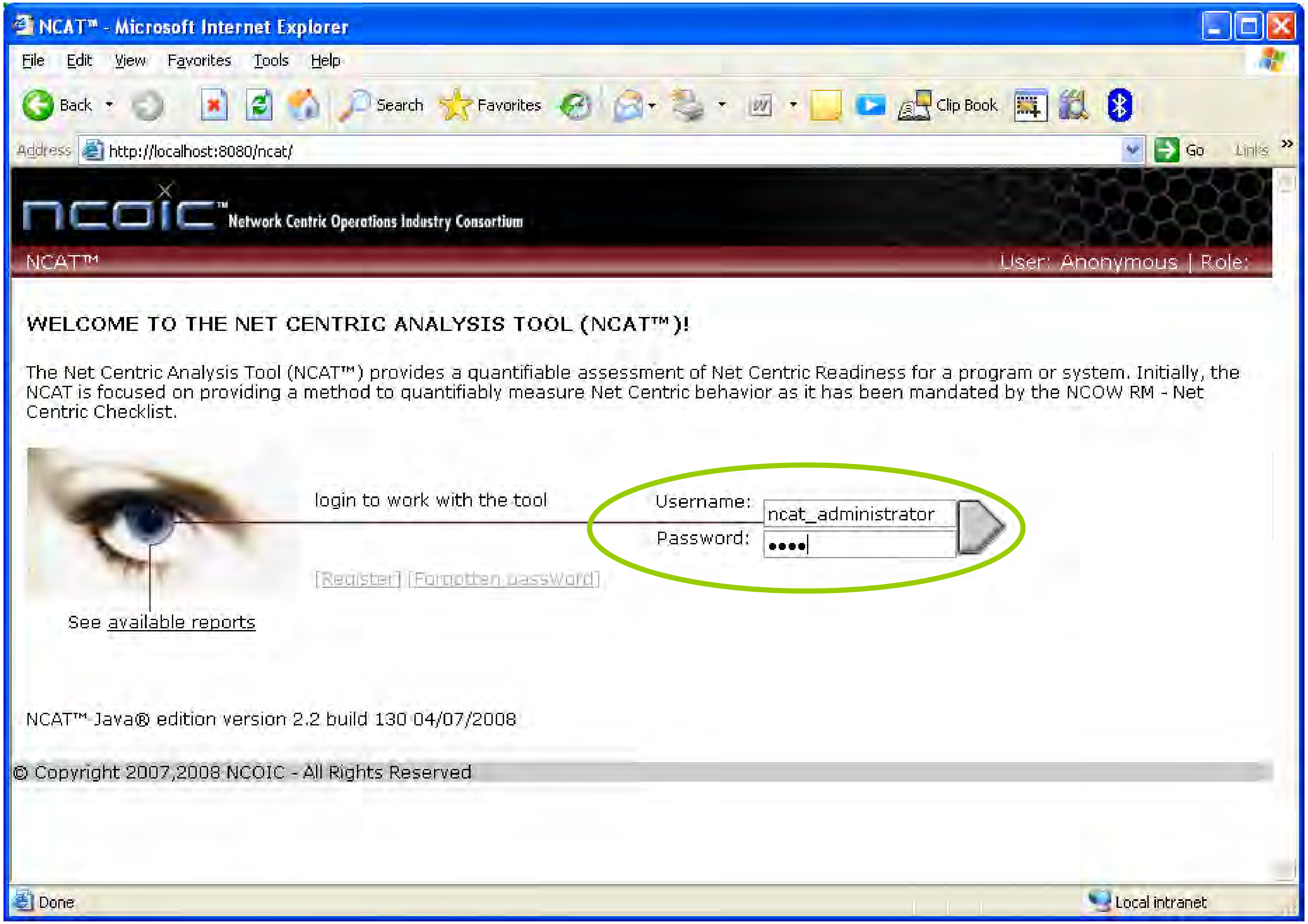
- 2. Double Click on 2-Start_JBoss.bat
- Wait for “Started in xx s”



Bring up web browser using "http://localhost:8080/ncat/"



Login as "ncat_administrator" using password "ncat"



Examine NCAT™ overview (HOME)

- We will inspect each
  - Users
  - Programs
  - Categories…
  - Profiles
  - Surveys (set planned)
  - Assessments
  - References
  - Guidelines
- Then we will:
  - Perform an assessment
  - Generate Reports
  - Analyze Results
- Click on "Users"

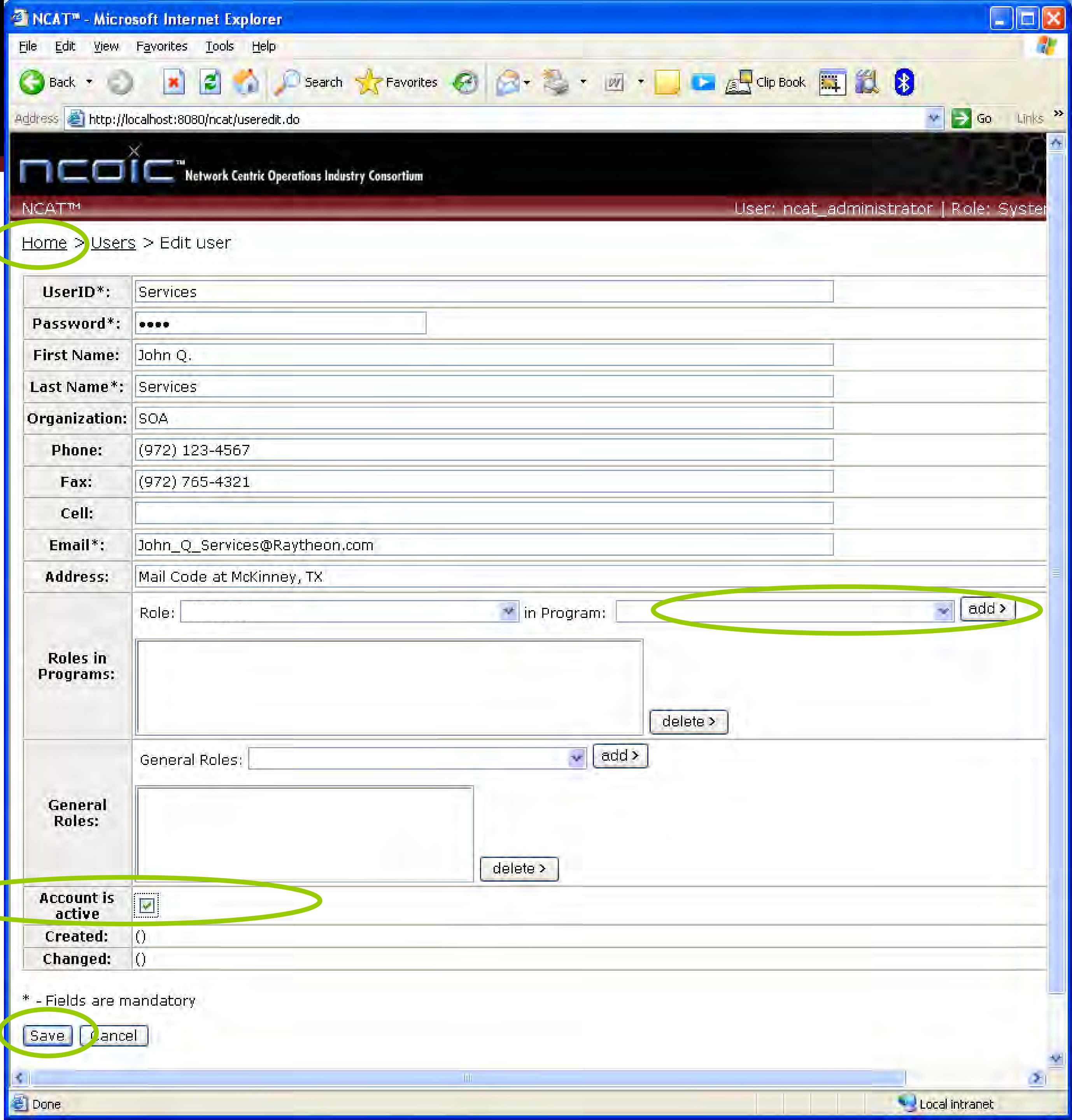
- User attributes = Roles + Programs
- Program (associated with a Survey)
  - Identifies the entity to be assessed
  - Partitions data between programs for privacy
- Categories
  - groups of Questions and Responses
- Profile (has a Top Level Category)
  - A tailored set of Questions and Responses grouped by Categories
- Survey = Program + (Assess1+Assess2+Assess x)
  - sets Planned Values
  - Associated with Profile & Program
  - Survey - aggregation of multiple assessments sharing a common Profile for a single program
- Assessment = User + Survey
  - Associated with User and Survey
  - Assessment is a single instance – one assessor, one set of questions
- Reports
  - Single Assessment or Survey Report with multiple Assessments
  - Compares Planned vs Actual
  - Export to Excel or other External Analysis Tools
- Import / Export Data

Examine NCAT™ overview (HOME)

- We need a Naming Convention to create each definition and know it is the right one for us
  - User named "Services, John Q."
  - Program "Services Program"
  - "Services" Category already exists
  - Profile "Services Profile"
  - Survey "Services Survey" (set planned values as admin)
  - Assessment – Note you can "View and delete"
  - Reference "Services Reference"
  - Guideline "Services Guideline"
- Then we will:
  - Logout as "ncat_administrator" and login as "Services"
  - Perform an assessment of the "Services Program"
  - Generate Reports on Single Assessment
  - Analyze Results

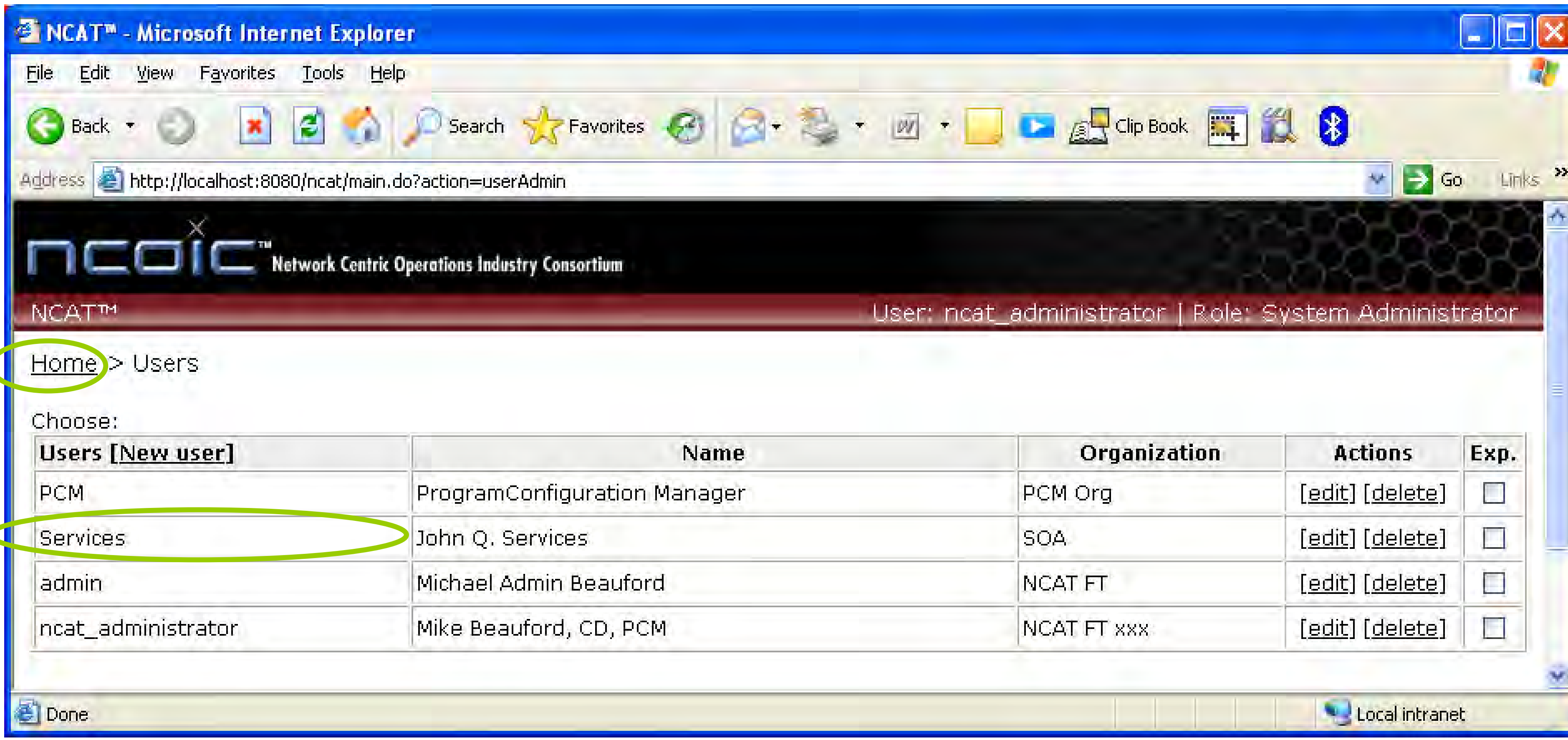
Setup User

- Pick "Services" Naming Convention first
- Fill in mandatory fields
- Have not set up Program yet so cannot assign role/program relationship
- Make sure you check the "Account is active" box.
- Save
- Come back later to add Program
- Click on "Home"



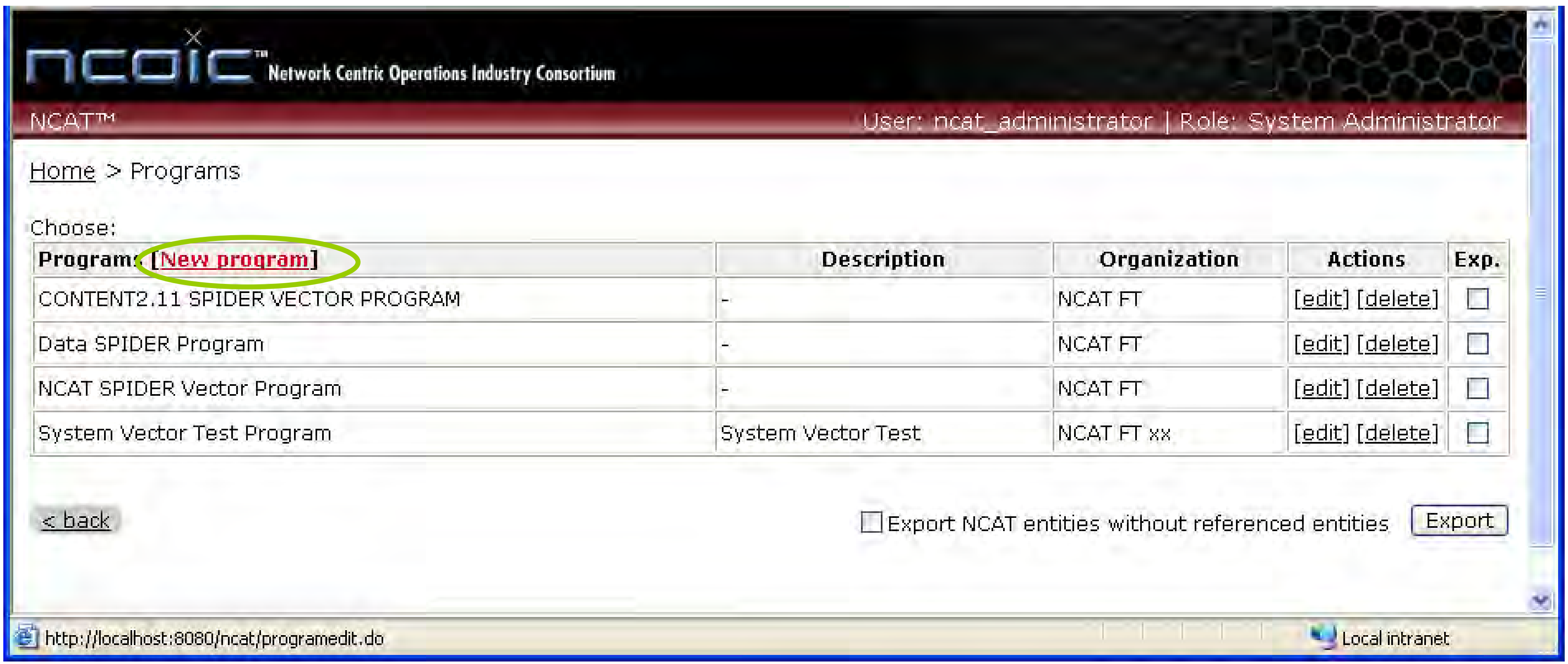
Confirm User “Services” is created

- Confirm on Users screen.
- Then Click on “Home” link. Then Click on “Programs” link.



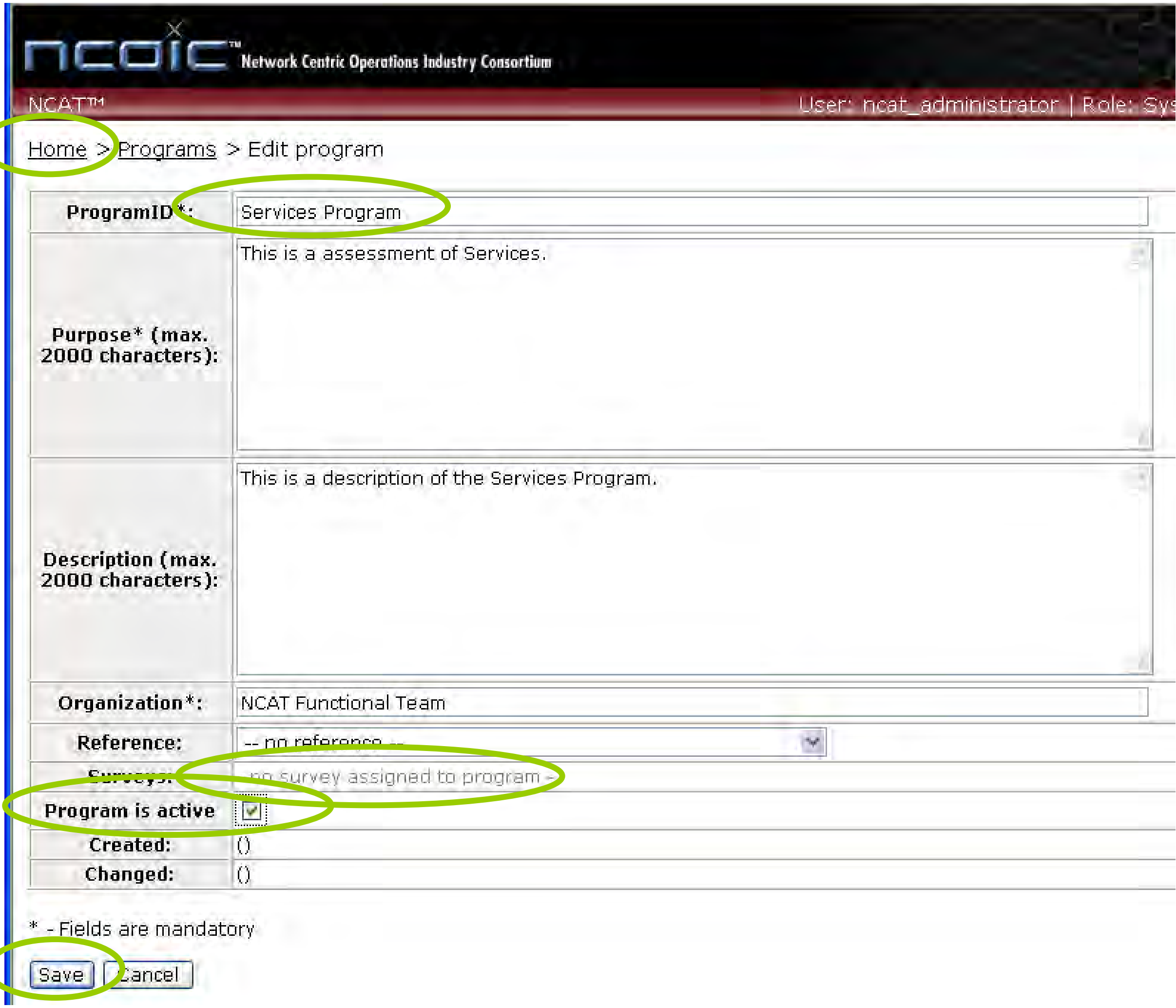
Setup Program

- Follow the “Services” Naming Convention
- Click on New Program to create a new “Services Program”



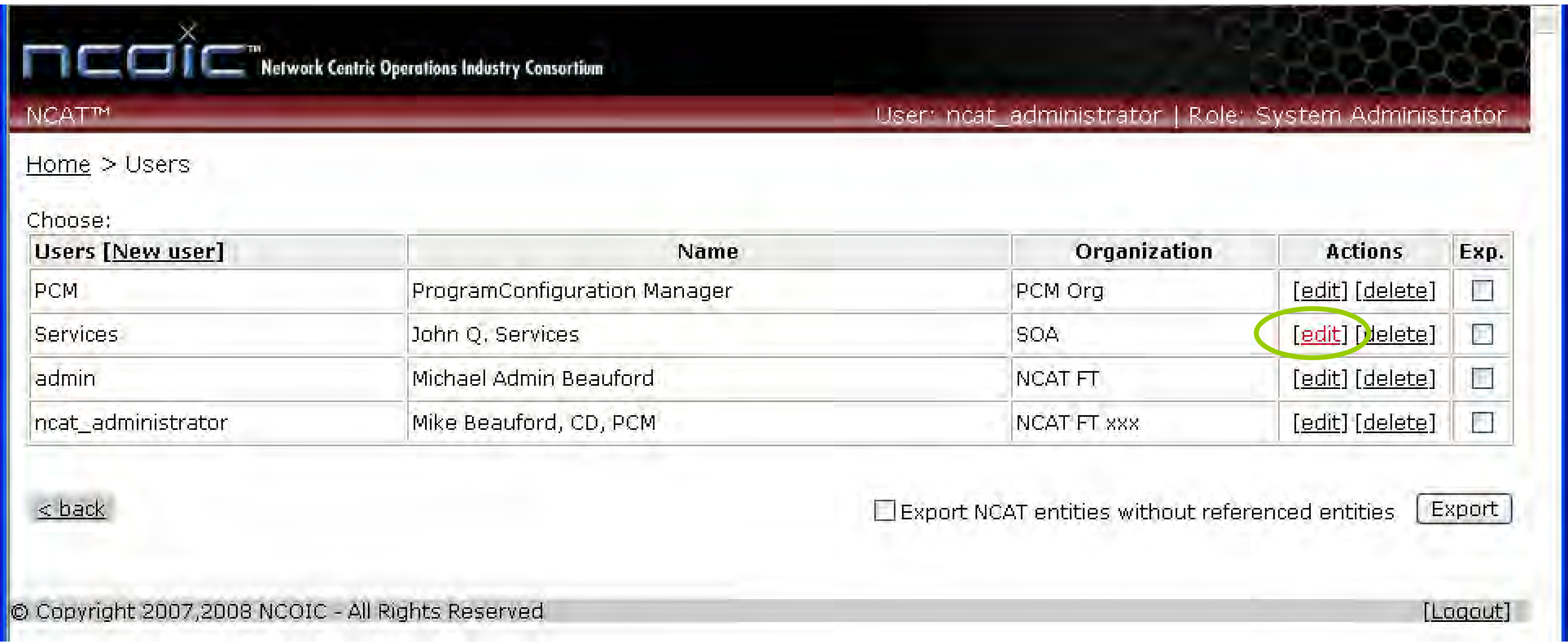
Fill in “Services Program” details

- Name it “Services Program”
- Fill in Mandatory Fields
- Skip References for now
- Note no Surveys are filled in
- Click on “Program is active”
- Click on “Save”
- Click on “Home”



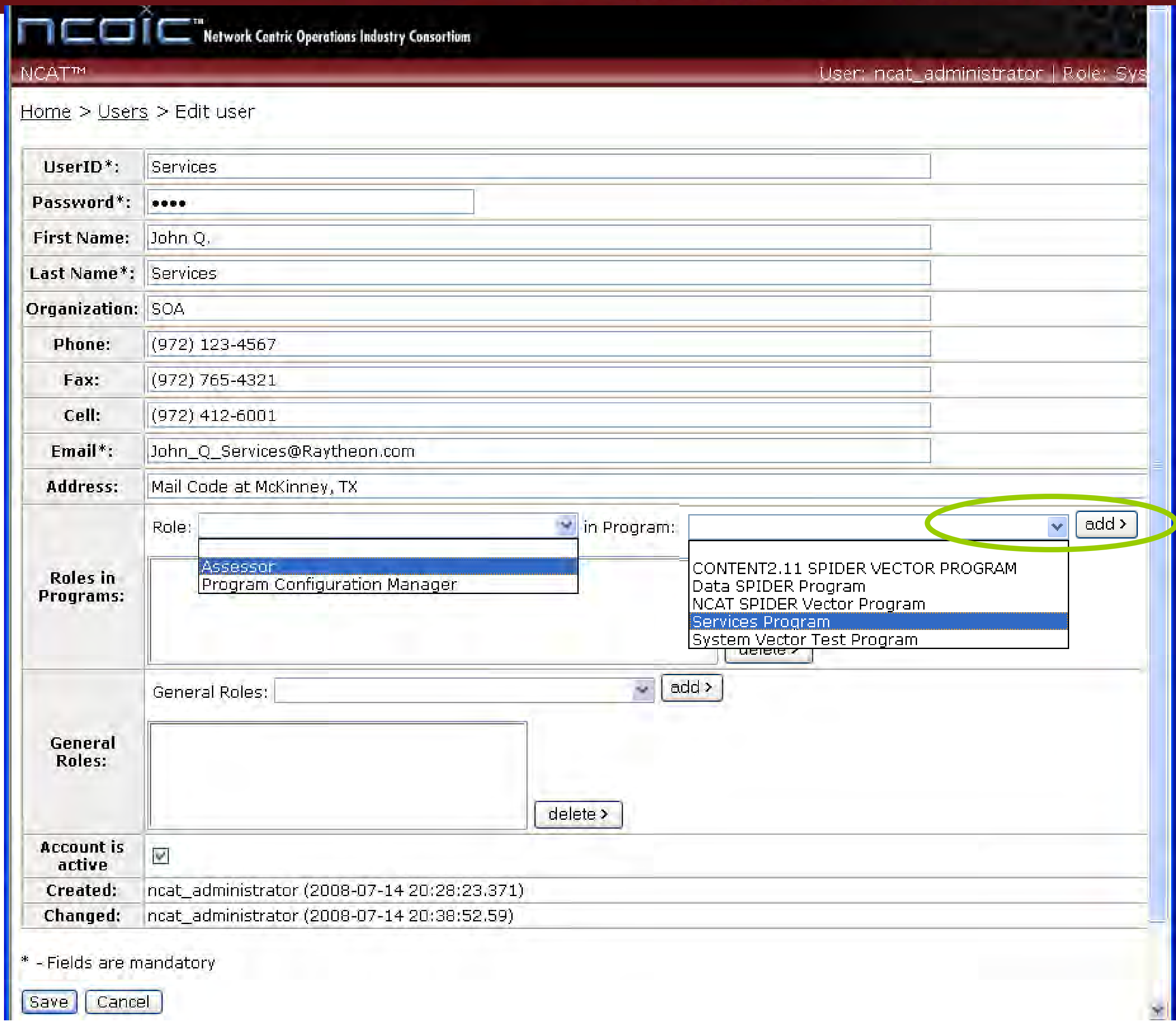
Associate Program with User

- From “Home” Click on “Users”
- On the “Services” row, Click on Edit under “Actions”

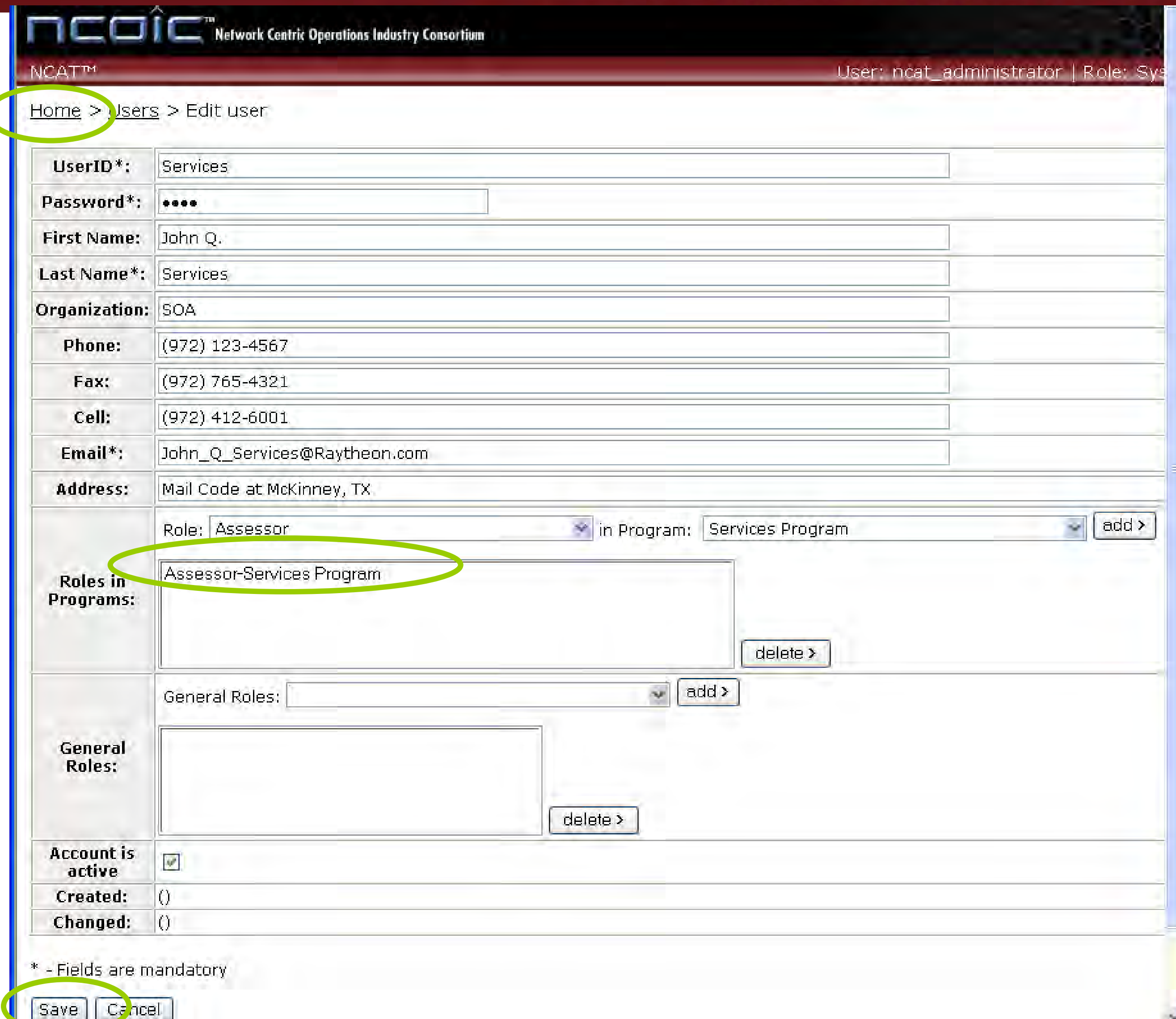


Associate Program with User

- Click on “Role” pull down
  - Select “Assessor”
- Click on “in_Program” pull down
  - Select “Services Program”
  - Click on “Add”



Associate Program with User



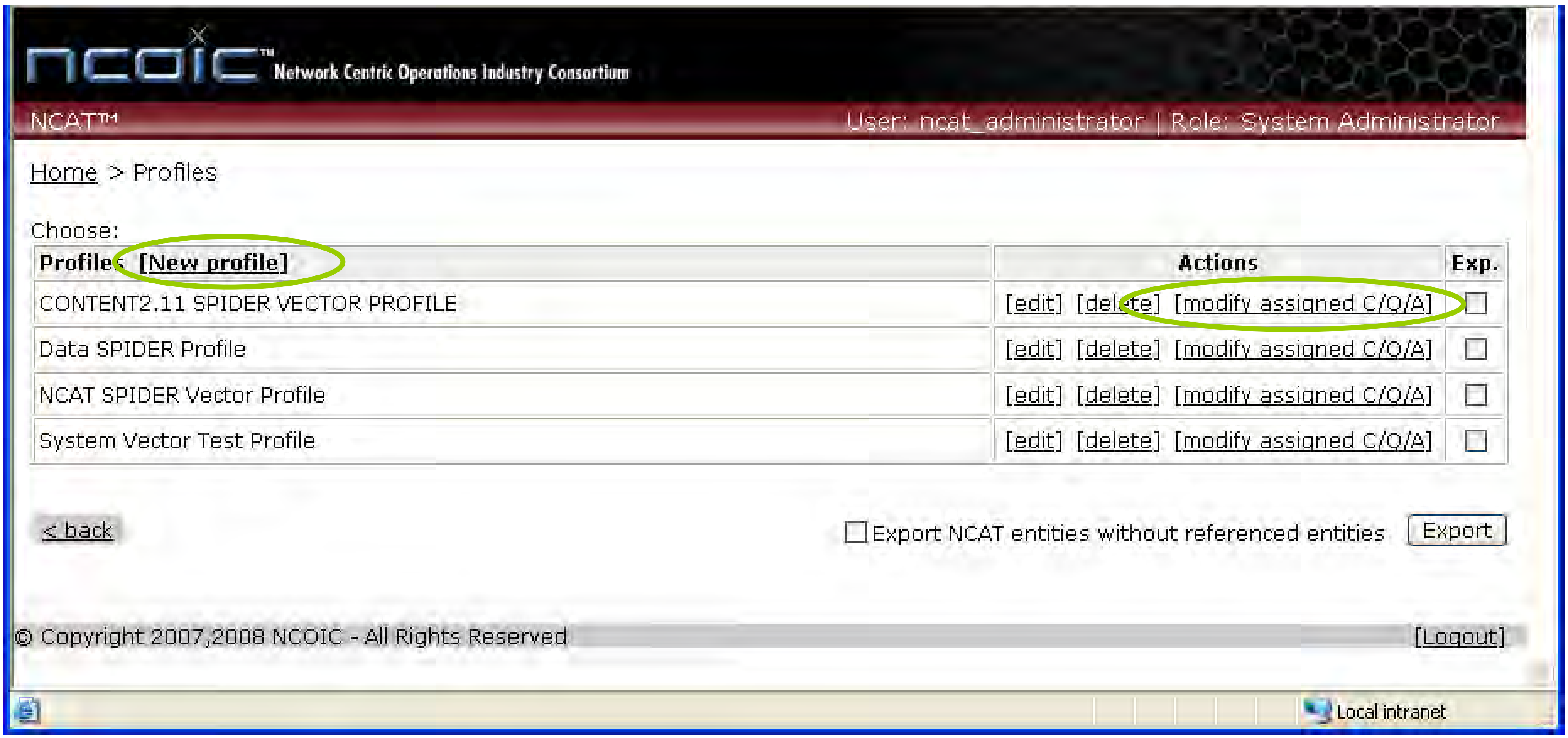
- Observe update to “Roles in Programs” concatenates “Assessor” – “Services Program”
- Click “Save” returns to “User” list
- Click “Home”

Setup Profile Next

- Since “Services” Category was already available, we will create a new Profile next.
- Click on “Profiles”

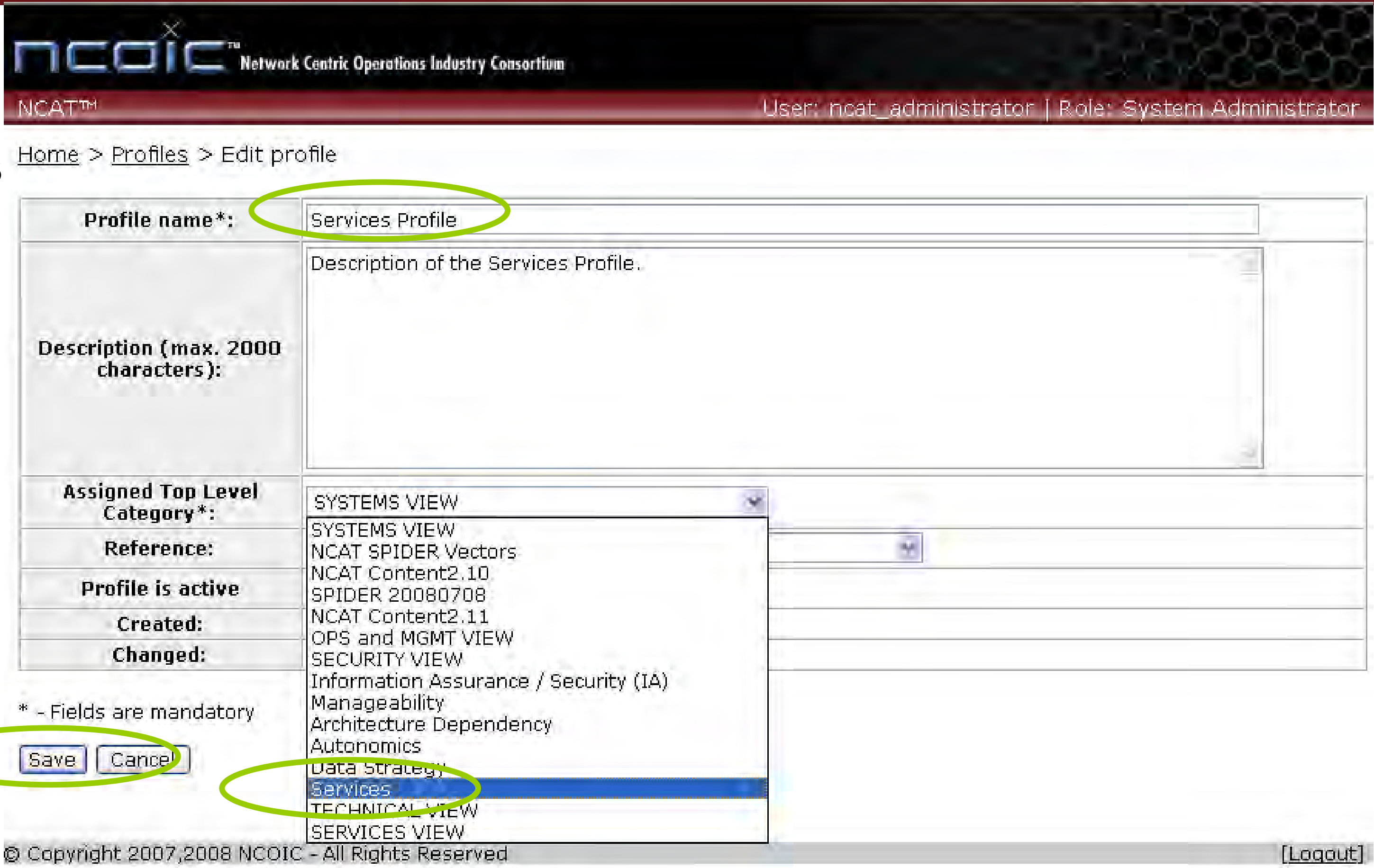
Setup New Profile

- Actions include “modify assigned C/Q/A*” (discussed later)
  – C/Q/A = Categories, Questions, Answers
- Click on “New Profile”



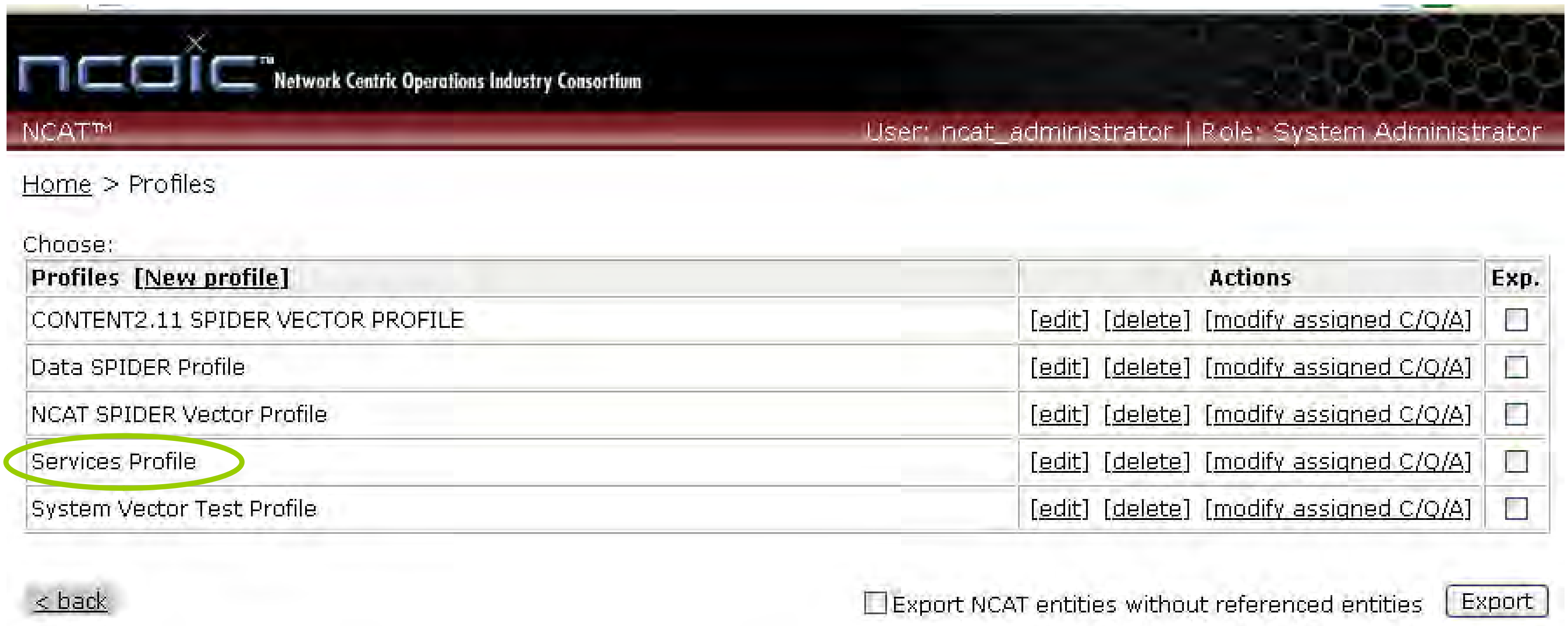
Create New “Services Profile”

- Name new profile “Services Profile”
- Fill Mandatory Fields
- Click on pull down for “Assign Top Level Category”
- Click on “Profile is active”
- Click on “Save” takes us back to “Profiles” page



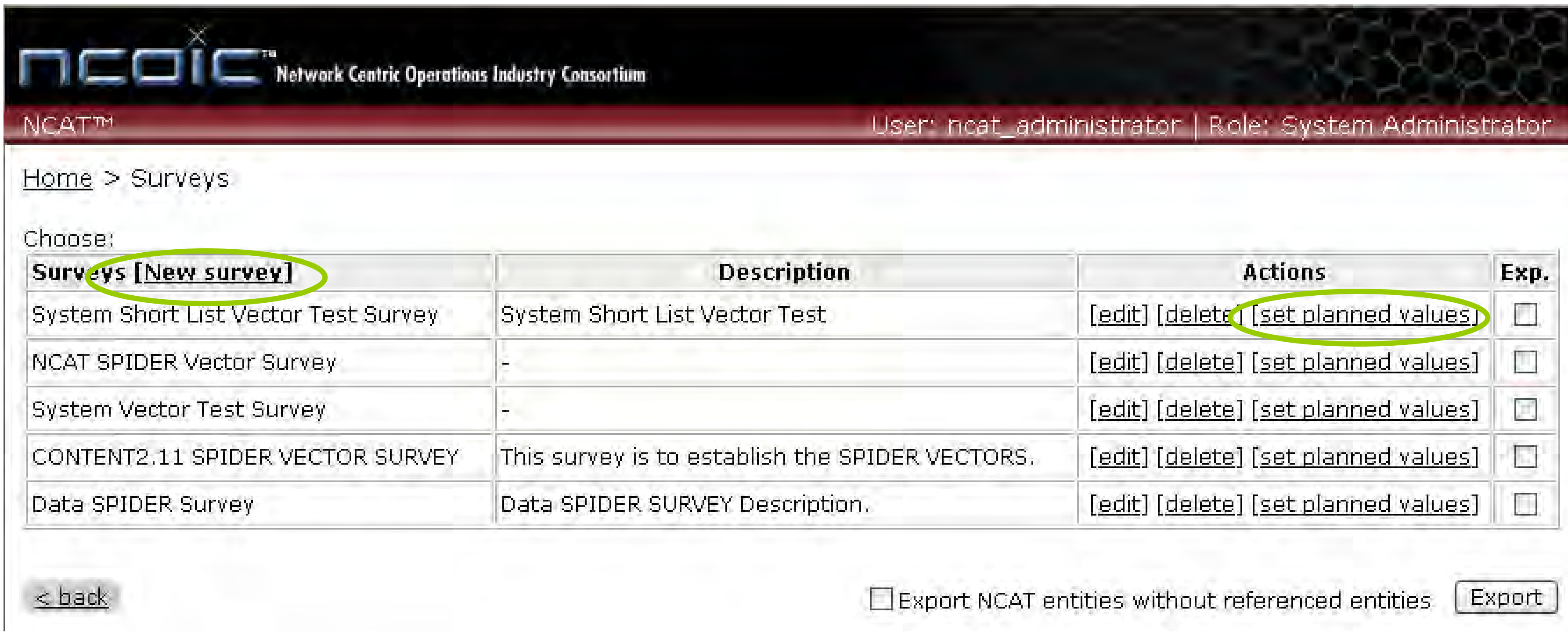
Confirm new “Services Profile”

- Confirm creation of new “Services Profile”
- Click on “Home”



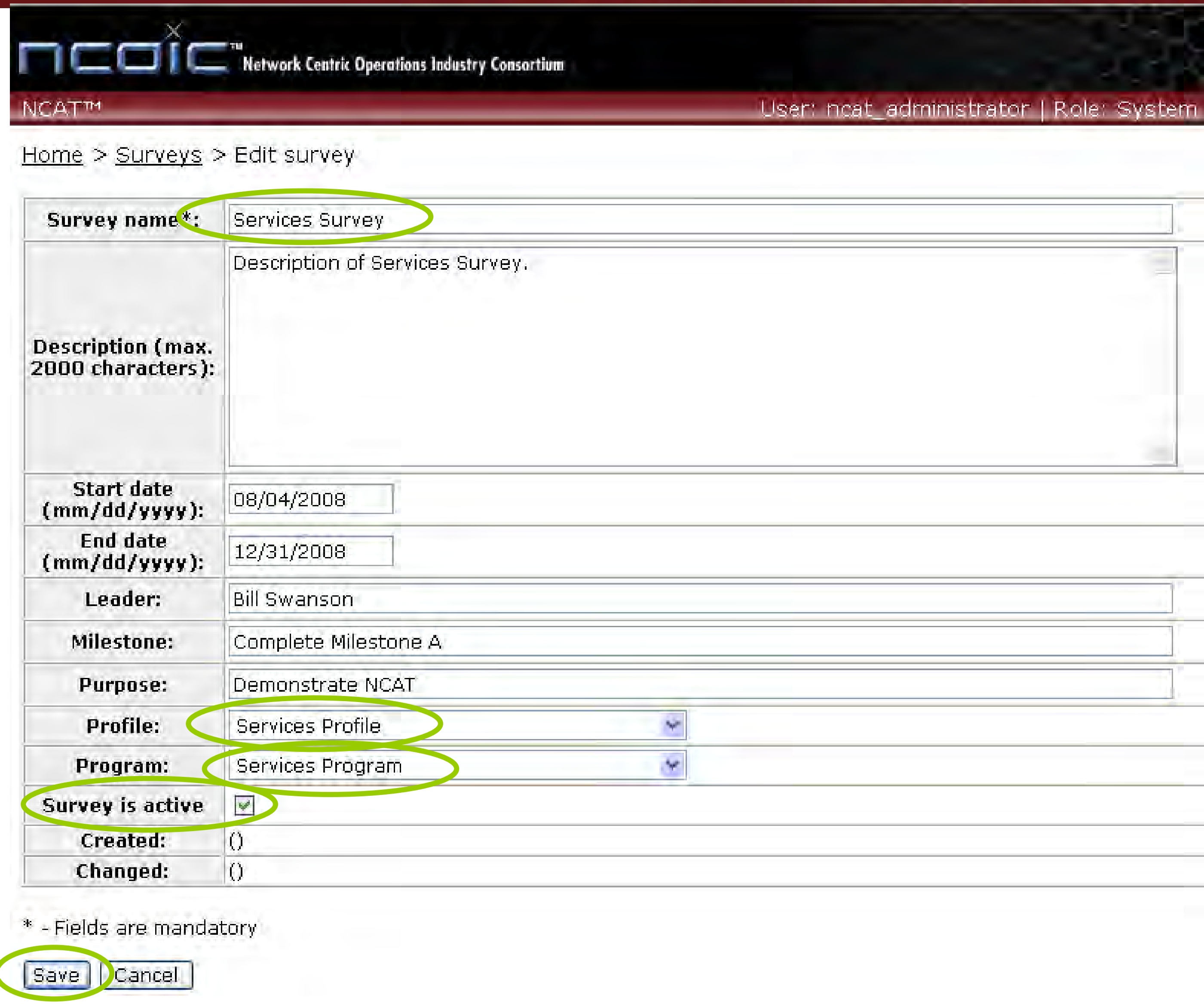
Setup New Survey

- Observe Actions include “set planned values*” (discuss later)
- Click on “New Survey”



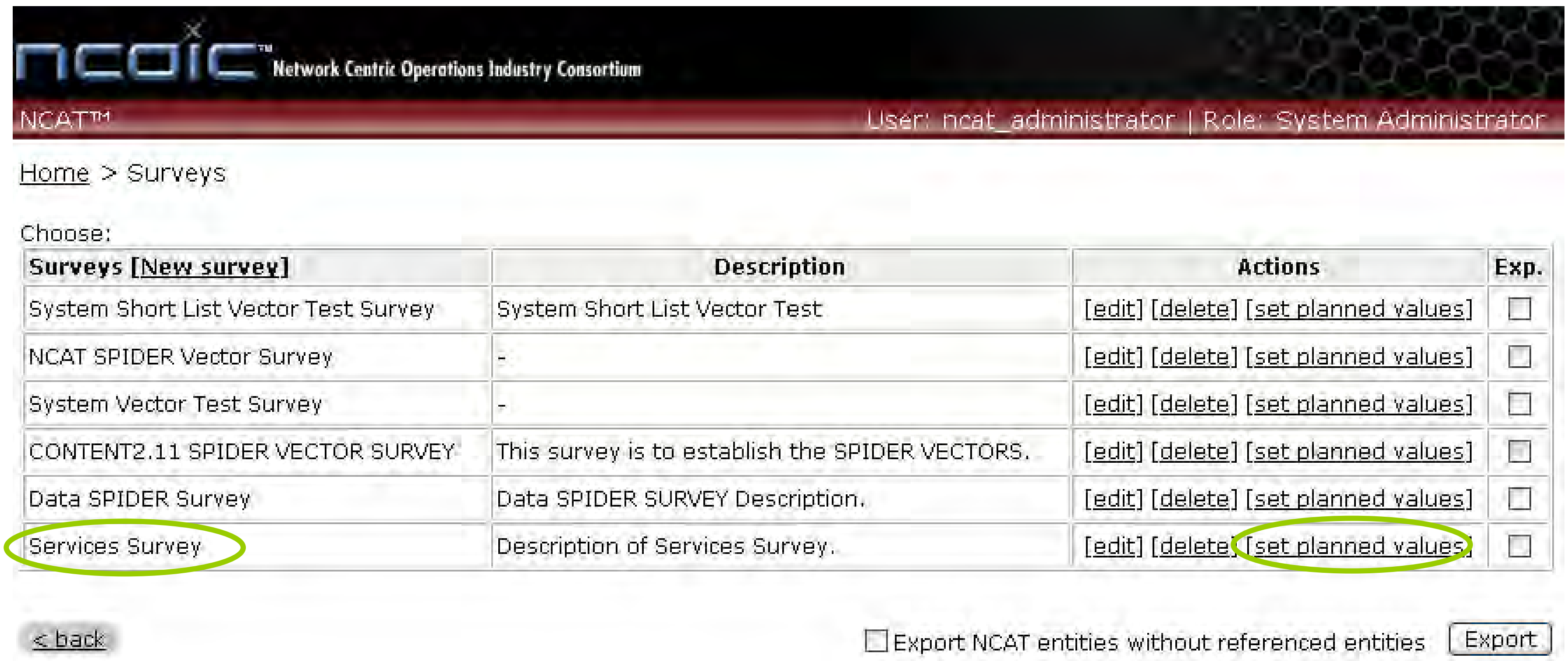
Create New “Services Survey”

- Name it “Services Survey”
- Fill Mandatory & Optional Fields
- Click on pull down for “Profile” and select “Services Profile”
- Click on pull down for “Program” and select “Services Program”
- Click on “Survey is active”
- Click on “Save” takes us back to “Surveys” page



Confirm new "Services Survey"

- Confirm creation of new "Services Survey"
- Click on "Services Survey" Actions "set planned values"
- Can only be set by "ncat_administrator"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Home > Surveys

Choose:

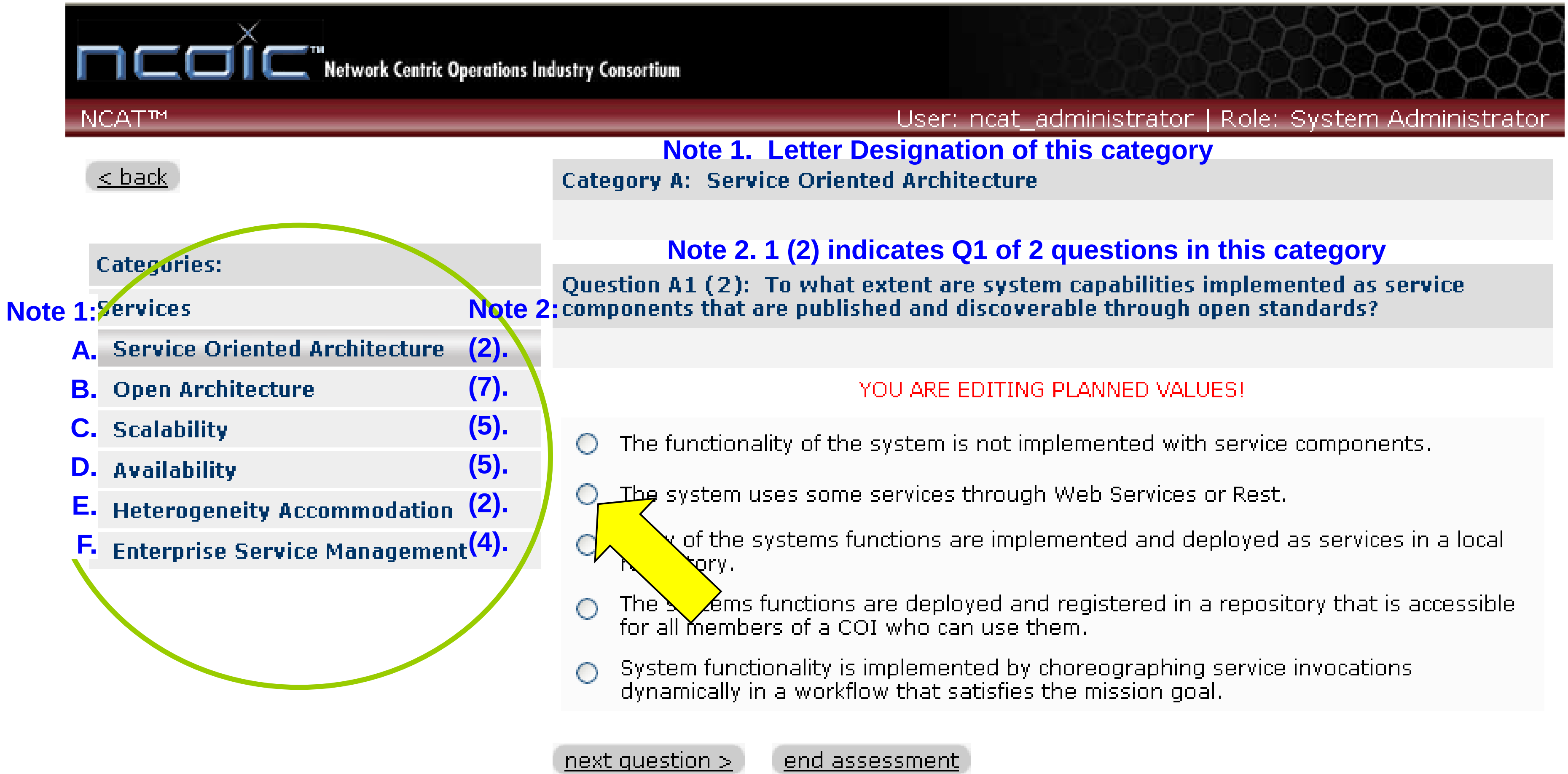
Surveys [New survey]	Description	Actions	Exp.
System Short List Vector Test Survey	System Short List Vector Test	[edit] [delete] [set planned values]	☐
NCAT SPIDER Vector Survey	-	[edit] [delete] [set planned values]	☐
System Vector Test Survey	-	[edit] [delete] [set planned values]	☐
CONTENT2.11 SPIDER VECTOR SURVEY	This survey is to establish the SPIDER VECTORS.	[edit] [delete] [set planned values]	☐
Data SPIDER Survey	Data SPIDER SURVEY Description.	[edit] [delete] [set planned values]	☐
Services Survey	Description of Services Survey.	[edit] [delete] [set planned values]	☐

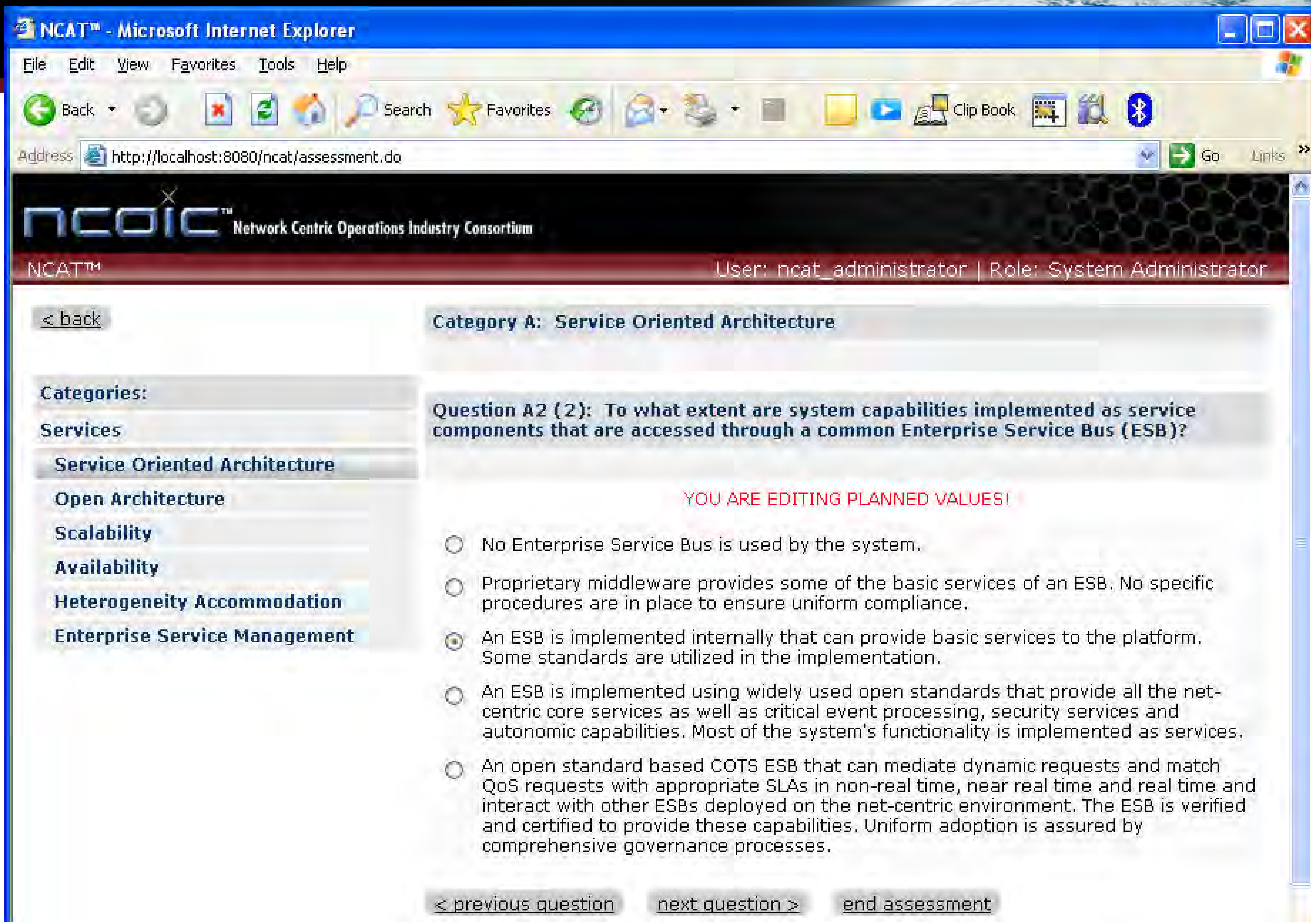
< back

☐ Export NCAT entities without referenced entities [Export]

Setting "Planned Values"

- Observe Services has six sub-categories which are labeled alphabetically.
- Letter A is "Service Oriented Architecture" which has 2 questions.
- Q1 of SOA is shown below.
- Pick 2nd choice "The System uses some services through ….." – The planned value
- Click "next question"

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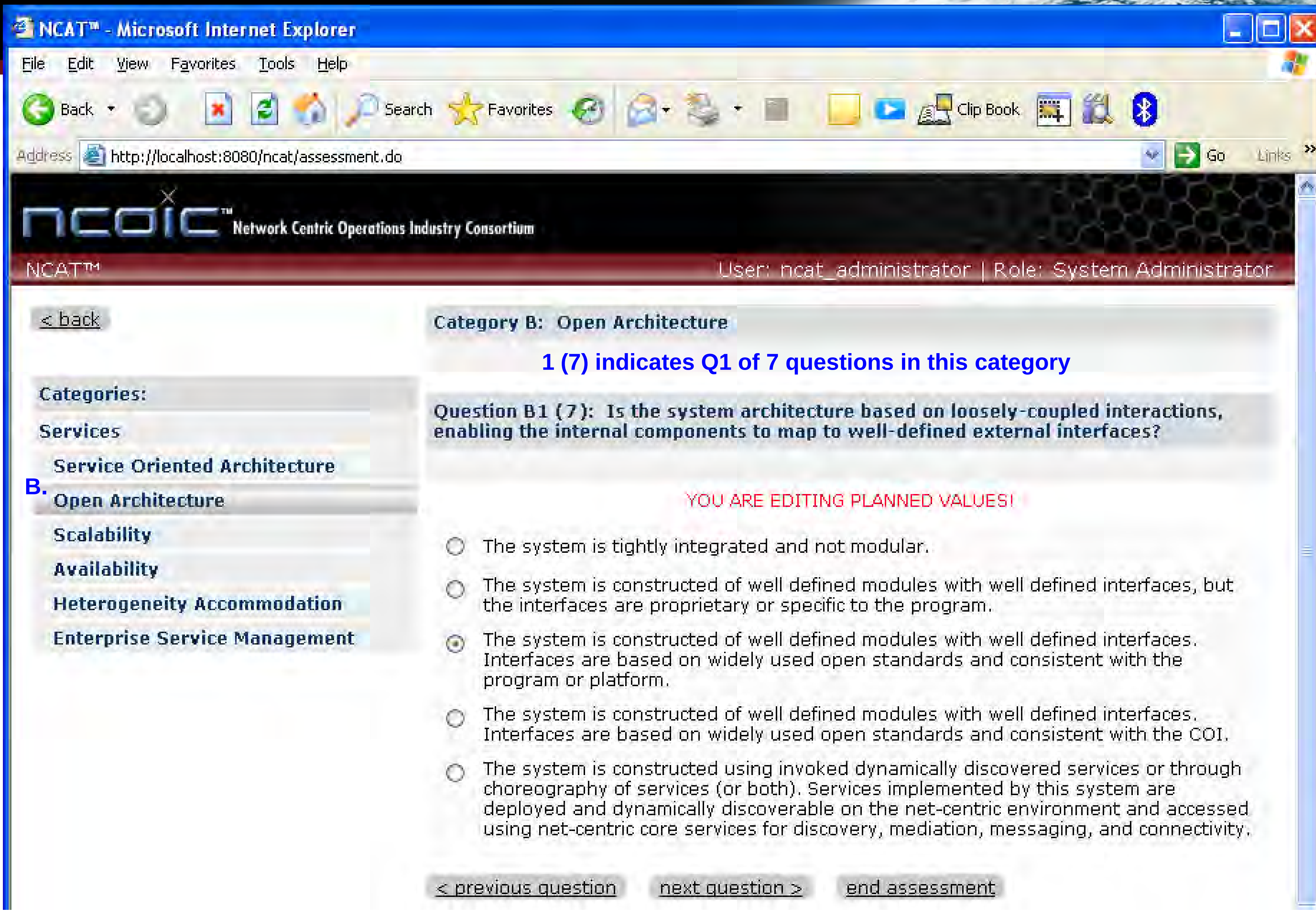
Category A: Service Oriented Architecture
Categories:
Services
Service Oriented Architecture
Open Architecture
Scalability
Availability
Heterogeneity Accommodation
Enterprise Service Management
Question A2 (2): To what extent are system capabilities implemented as service components that are accessed through a common Enterprise Service Bus (ESB)?
YOU ARE EDITING PLANNED VALUES!
No Enterprise Service Bus is used by the system.
Proprietary middleware provides some of the basic services of an ESB. No specific procedures are in place to ensure uniform compliance.
An ESB is implemented internally that can provide basic services to the platform. Some standards are utilized in the implementation.
An ESB is implemented using widely used open standards that provide all the net-centric core services as well as critical event processing, security services and autonomic capabilities. Most of the system's functionality is implemented as services.
An open standard based COTS ESB that can mediate dynamic requests and match QoS requests with appropriate SLAs in non-real time, near real time and real time and interact with other ESBs deployed on the net-centric environment. The ESB is verified and certified to provide these capabilities. Uniform adoption is assured by comprehensive governance processes.
< previous question
next question >
end assessment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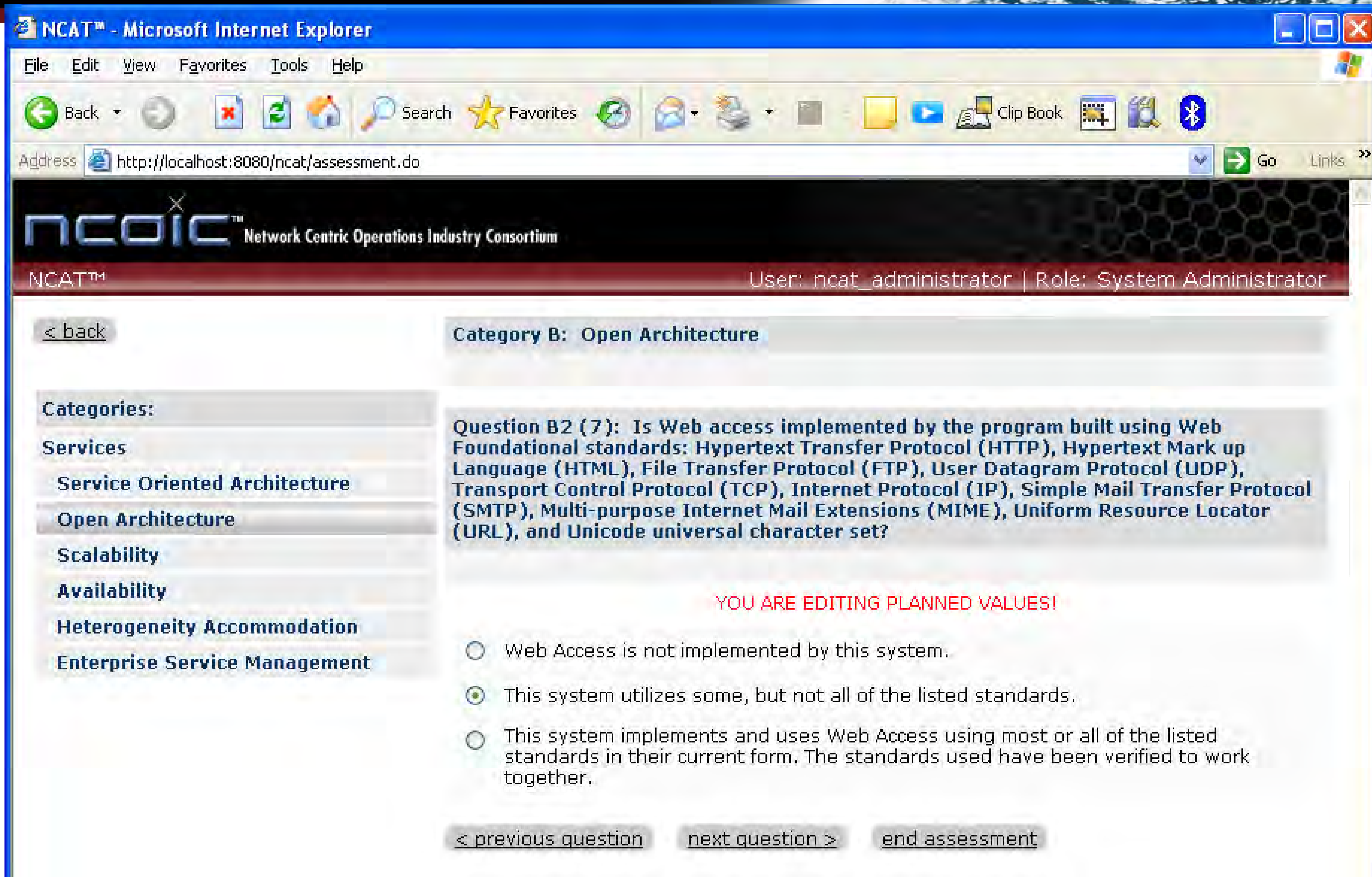
Category B: Open Architecture
1 (7) indicates Q1 of 7 questions in this category
Categories:
Services
Service Oriented Architecture
B.
Open Architecture
Scalability
Availability
Heterogeneity Accommodation
Enterprise Service Management
Question B1 (7): Is the system architecture based on loosely-coupled interactions, enabling the internal components to map to well-defined external interfaces?
YOU ARE EDITING PLANNED VALUES!
The system is tightly integrated and not modular.
The system is constructed of well defined modules with well defined interfaces, but the interfaces are proprietary or specific to the program.
The system is constructed of well defined modules with well defined interfaces. Interfaces are based on widely used open standards and consistent with the program or platform.
The system is constructed of well defined modules with well defined interfaces. Interfaces are based on widely used open standards and consistent with the COI.
The system is constructed using invoked dynamically discovered services or through choreography of services (or both). Services implemented by this system are deployed and dynamically discoverable on the net-centric environment and accessed using net-centric core services for discovery, mediation, messaging, and connectivity.
< previous question
next question >
end assessment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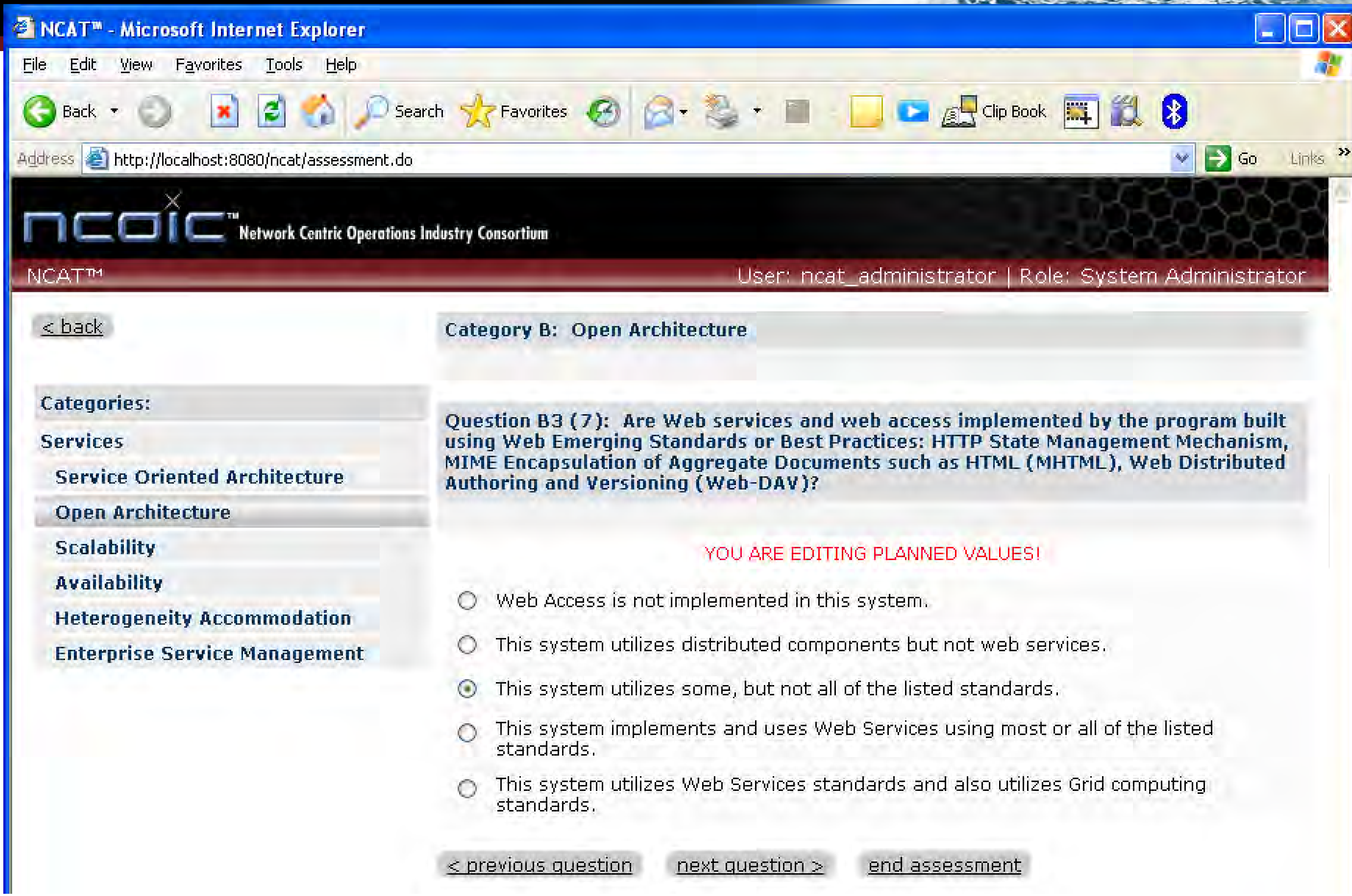
Category B: Open Architecture
Categories:
Services
Service Oriented Architecture
Open Architecture
Scalability
Availability
Heterogeneity Accommodation
Enterprise Service Management
Question B2 (7): Is Web access implemented by the program built using Web Foundational standards: Hypertext Transfer Protocol (HTTP), Hypertext Mark up Language (HTML), File Transfer Protocol (FTP), User Datagram Protocol (UDP), Transport Control Protocol (TCP), Internet Protocol (IP), Simple Mail Transfer Protocol (SMTP), Multi-purpose Internet Mail Extensions (MIME), Uniform Resource Locator (URL), and Unicode universal character set?
YOU ARE EDITING PLANNED VALUES!
Web Access is not implemented by this system.
This system utilizes some, but not all of the listed standards.
This system implements and uses Web Access using most or all of the listed standards in their current form. The standards used have been verified to work together.
< previous question
next question >
end assessment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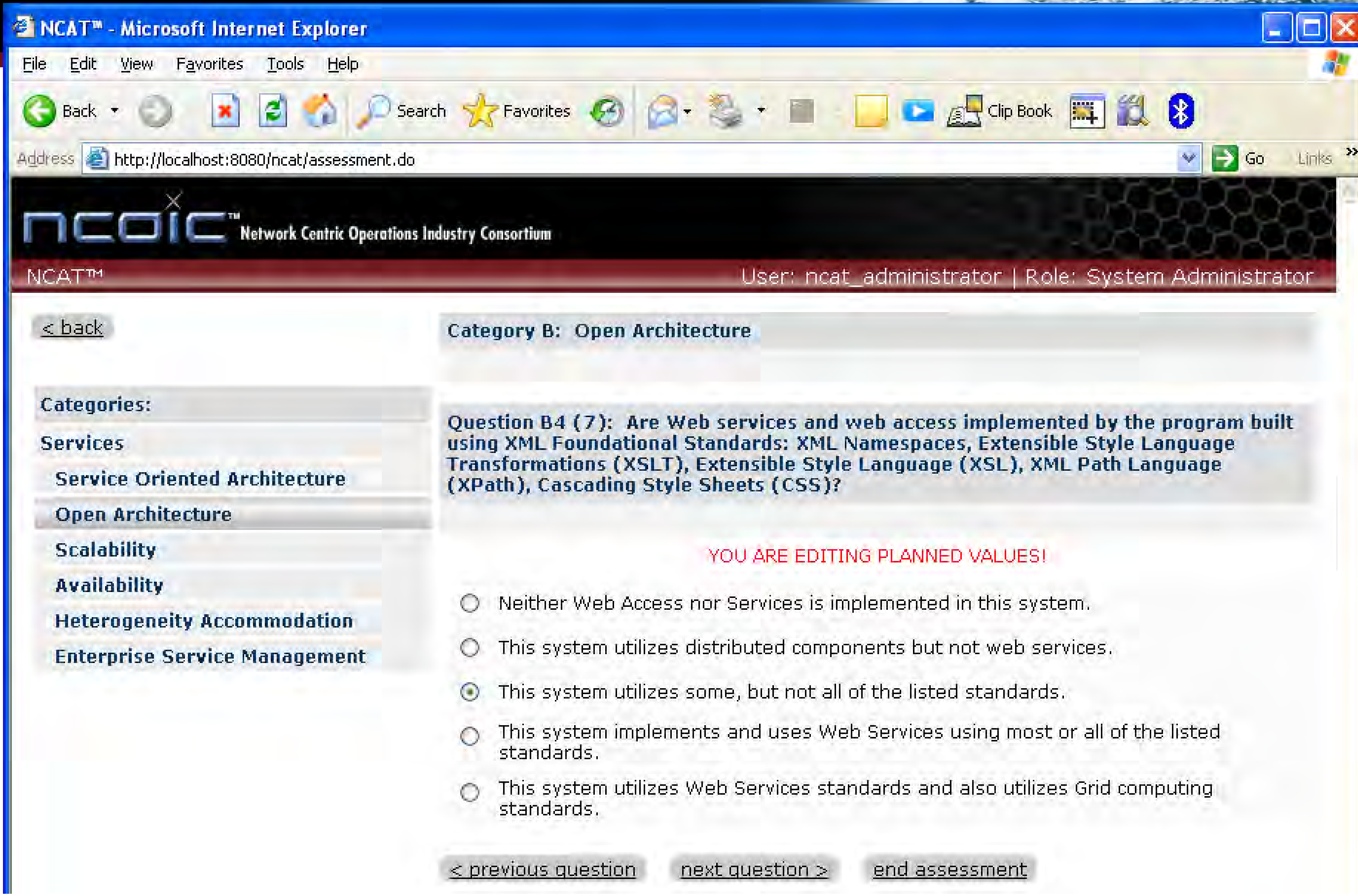
Category B: Open Architecture
Categories:
Services
Service Oriented Architecture
Open Architecture
Scalability
Availability
Heterogeneity Accommodation
Enterprise Service Management
Question B3 (7): Are Web services and web access implemented by the program built using Web Emerging Standards or Best Practices: HTTP State Management Mechanism, MIME Encapsulation of Aggregate Documents such as HTML (MHTML), Web Distributed Authoring and Versioning (Web-DAV)?
YOU ARE EDITING PLANNED VALUES!
Web Access is not implemented in this system.
This system utilizes distributed components but not web services.
This system utilizes some, but not all of the listed standards.
This system implements and uses Web Services using most or all of the listed standards.
This system utilizes Web Services standards and also utilizes Grid computing standards.
< previous question
next question >
end assessment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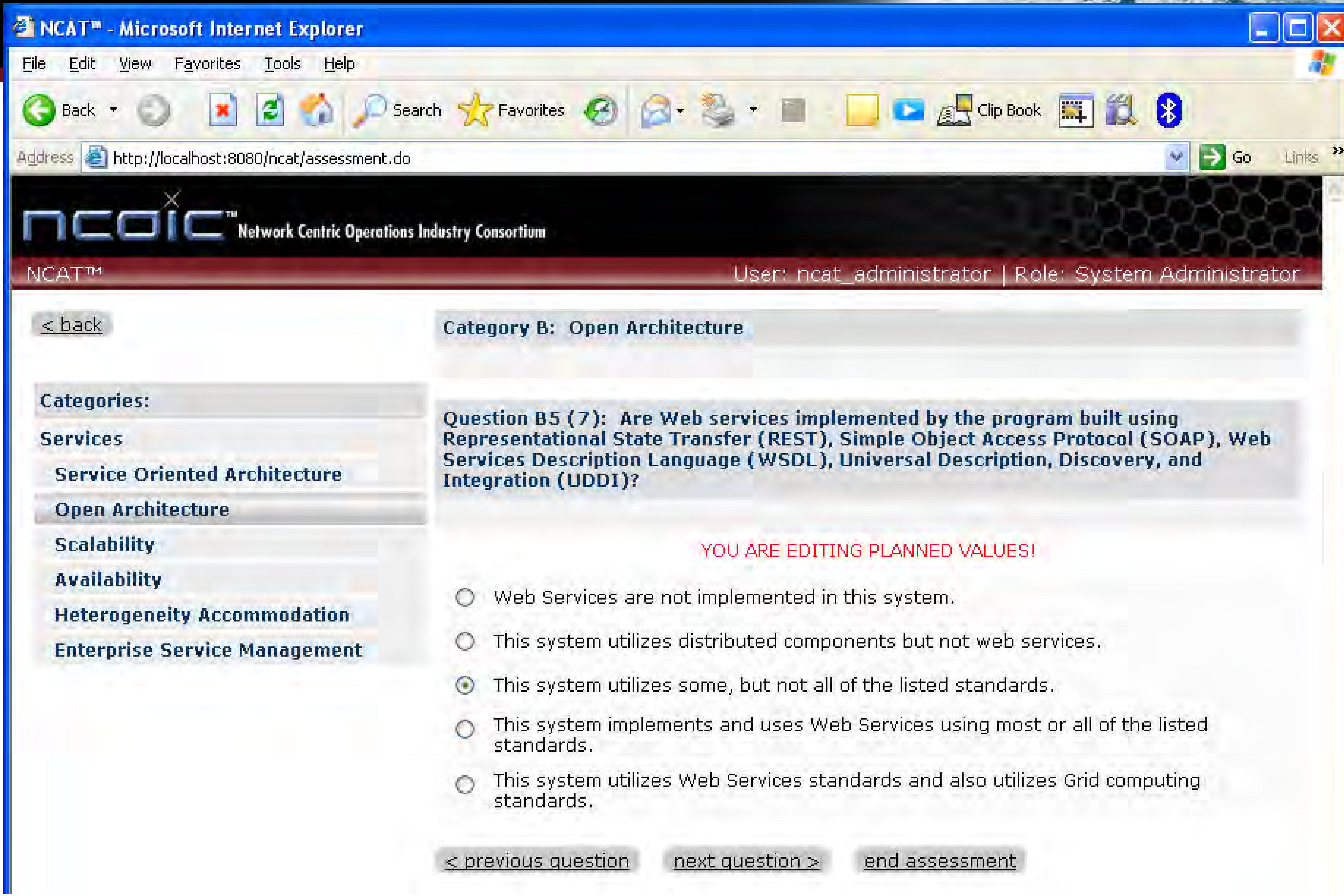
Category B: Open Architecture
Categories:
Services
Service Oriented Architecture
Open Architecture
Scalability
Availability
Heterogeneity Accommodation
Enterprise Service Management
Question B4 (7): Are Web services and web access implemented by the program built using XML Foundational Standards: XML Namespaces, Extensible Style Language Transformations (XSLT), Extensible Style Language (XSL), XML Path Language (XPath), Cascading Style Sheets (CSS)?
YOU ARE EDITING PLANNED VALUES!
Neither Web Access nor Services is implemented in this system.
This system utilizes distributed components but not web services.
This system utilizes some, but not all of the listed standards.
This system implements and uses Web Services using most or all of the listed standards.
This system utilizes Web Services standards and also utilizes Grid computing standards.
< previous question
next question >
end assessment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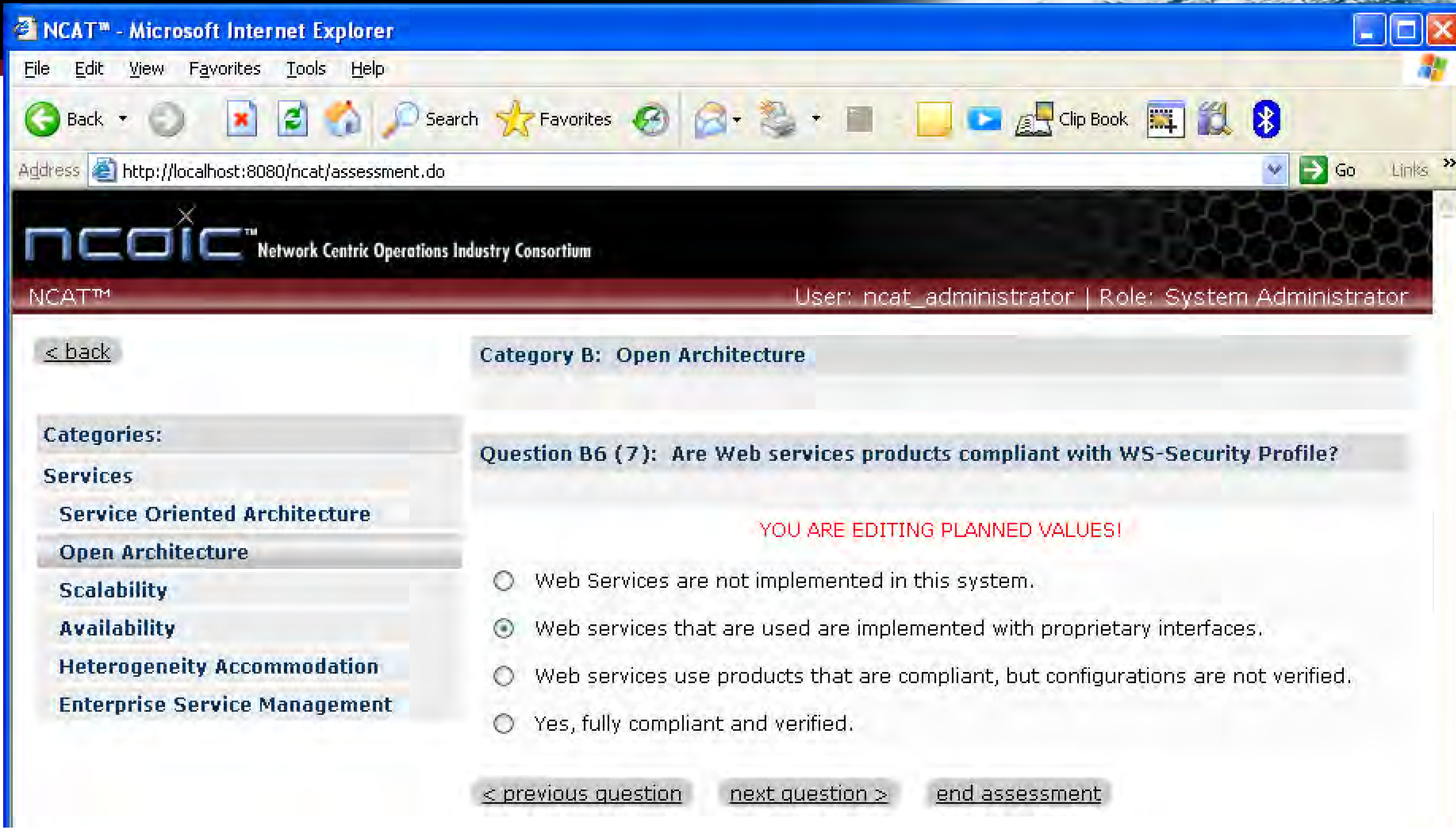
Category B: Open Architecture
Categories:
Services
Service Oriented Architecture
Open Architecture
Scalability
Availability
Heterogeneity Accommodation
Enterprise Service Management
Question B5 (7): Are Web services implemented by the program built using Representational State Transfer (REST), Simple Object Access Protocol (SOAP), Web Services Description Language (WSDL), Universal Description, Discovery, and Integration (UDDI)?
YOU ARE EDITING PLANNED VALUES!
Web Services are not implemented in this system.
This system utilizes distributed components but not web services.
This system utilizes some, but not all of the listed standards.
This system implements and uses Web Services using most or all of the listed standards.
This system utilizes Web Services standards and also utilizes Grid computing standards.
< previous question
next question >
end assessment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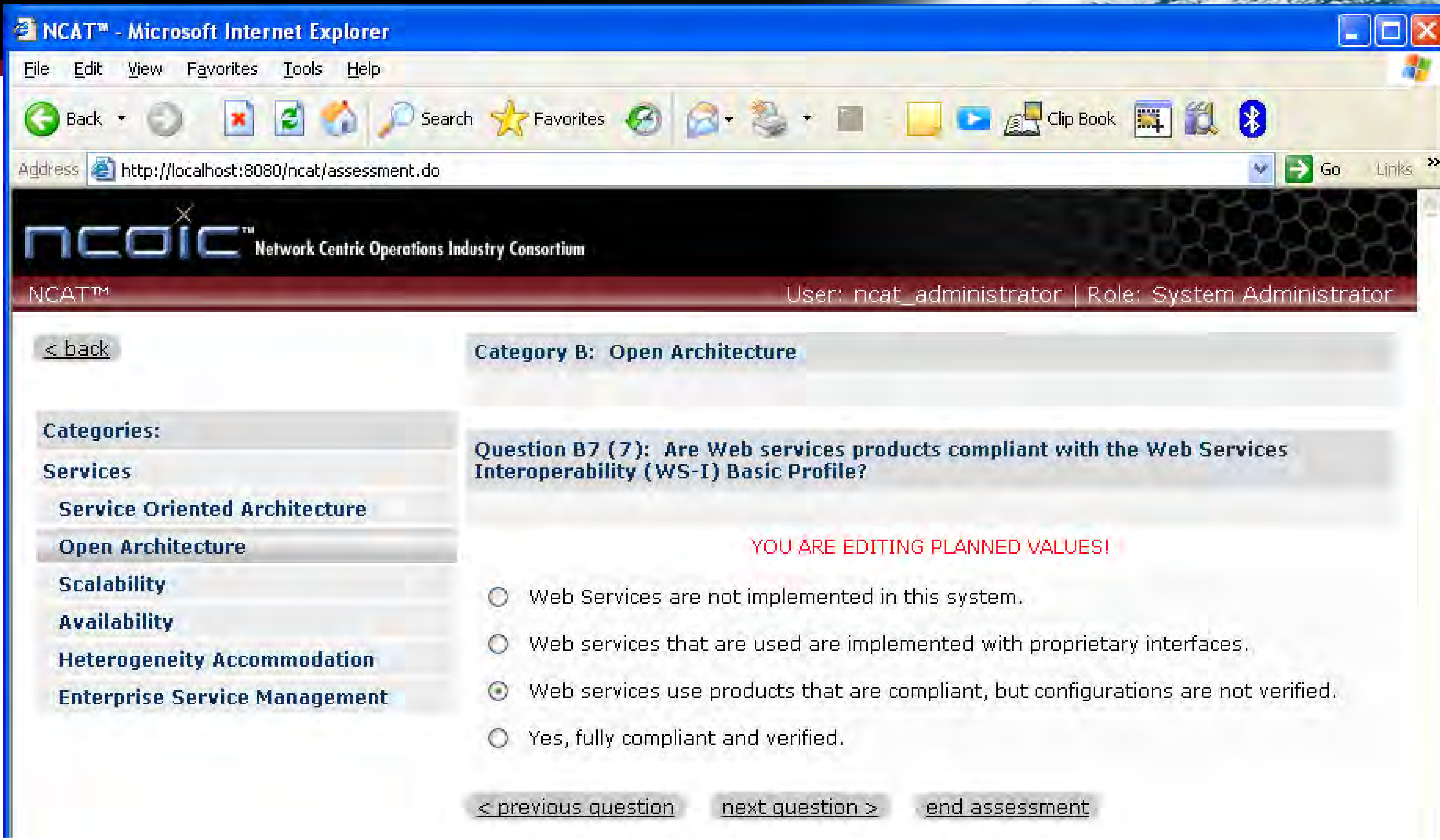
Category B: Open Architecture
Categories:
Services
Service Oriented Architecture
Open Architecture
Scalability
Availability
Heterogeneity Accommodation
Enterprise Service Management
Question B6 (7): Are Web services products compliant with WS-Security Profile?
YOU ARE EDITING PLANNED VALUES!
Web Services are not implemented in this system.
Web services that are used are implemented with proprietary interfaces.
Web services use products that are compliant, but configurations are not verified.
Yes, fully compliant and verified.
< previous question
next question >
end assessment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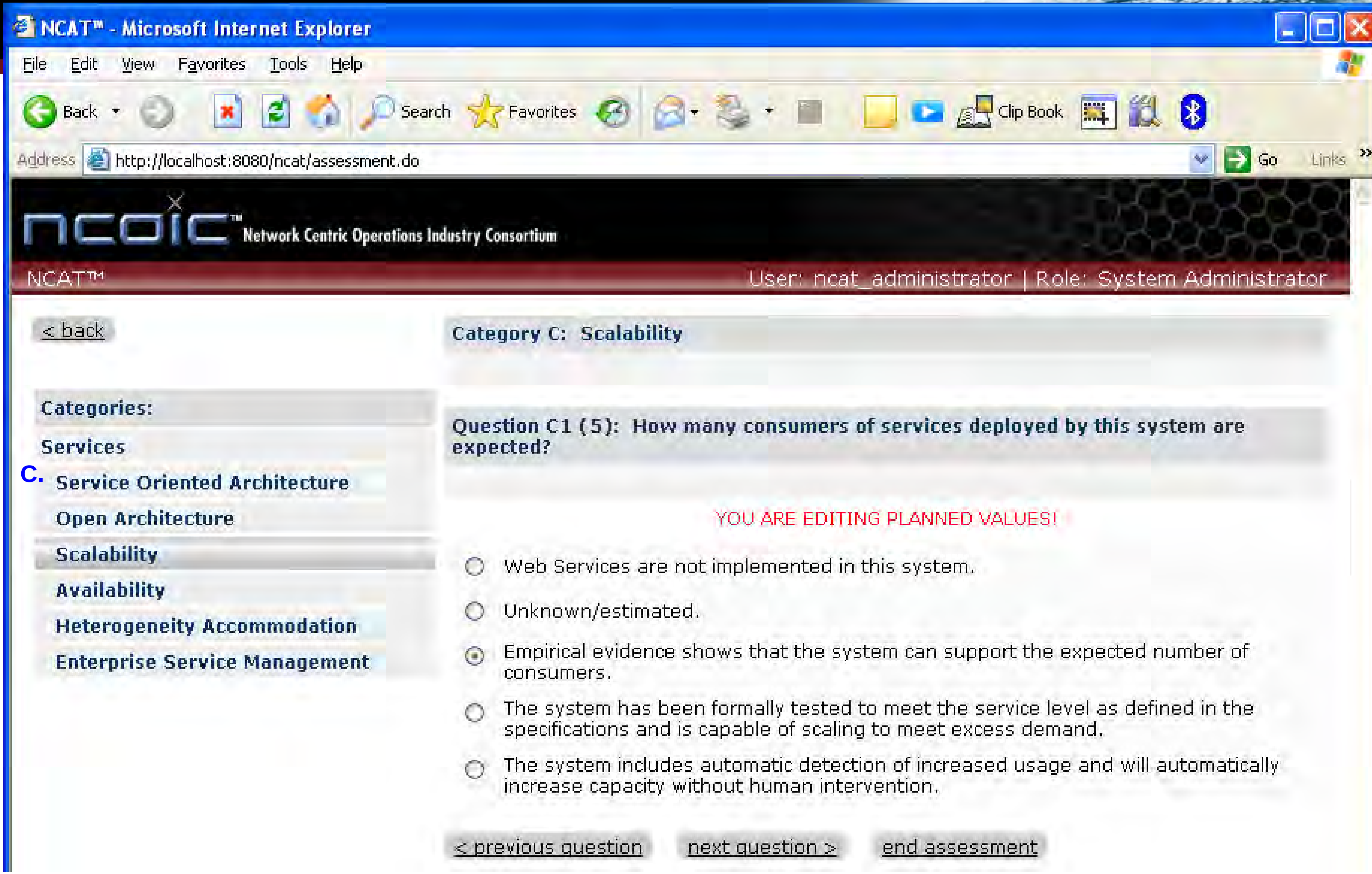
Category B: Open Architecture
Categories:
Services
Service Oriented Architecture
Open Architecture
Scalability
Availability
Heterogeneity Accommodation
Enterprise Service Management
Question B7 (7): Are Web services products compliant with the Web Services Interoperability (WS-I) Basic Profile?
YOU ARE EDITING PLANNED VALUES!
Web Services are not implemented in this system.
Web services that are used are implemented with proprietary interfaces.
Web services use products that are compliant, but configurations are not verified.
Yes, fully compliant and verified.
< previous question
next question >
end assessment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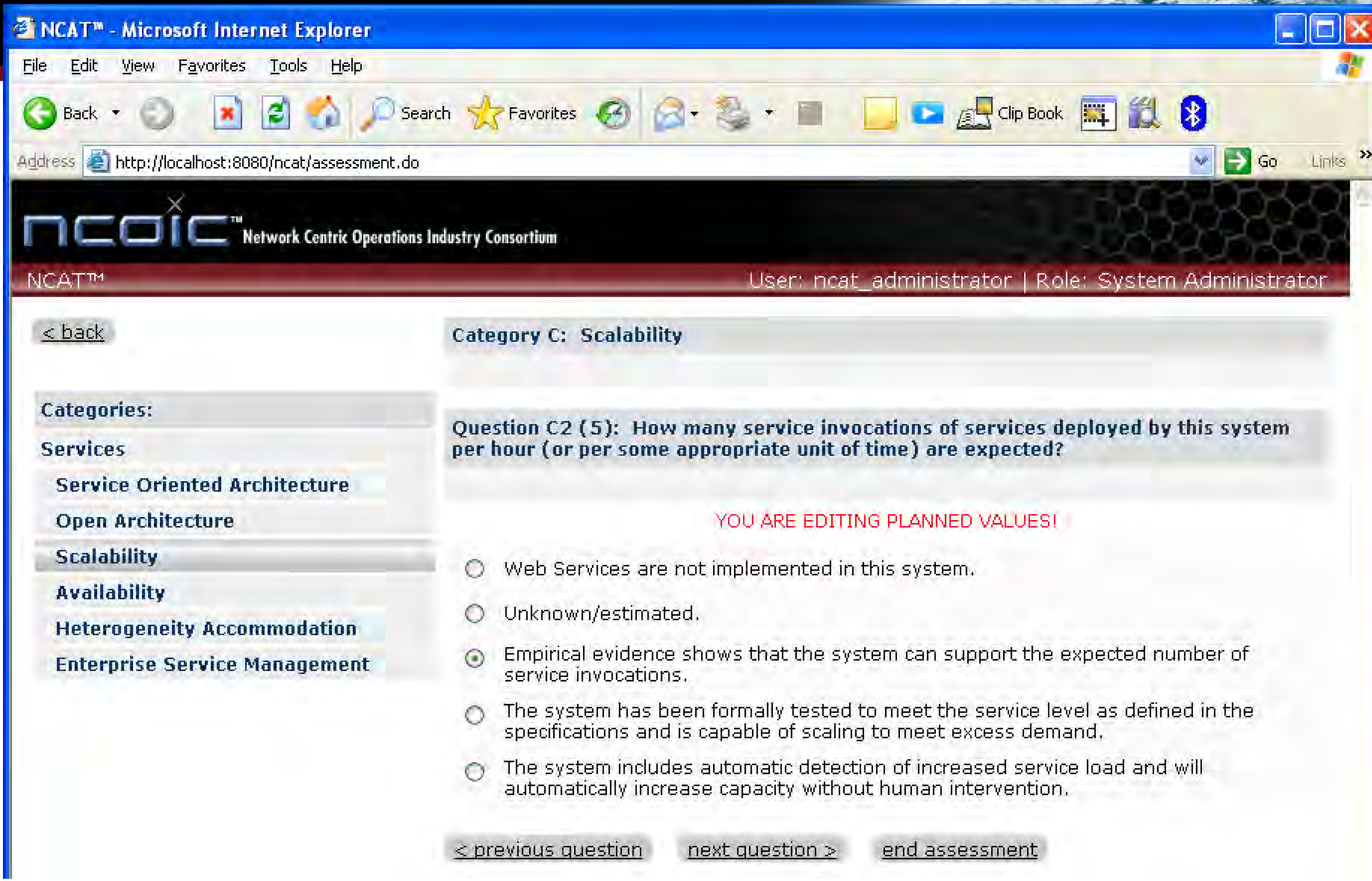
Category C: Scalability
Categories:
Services
C.
Service Oriented Architecture
Open Architecture
Scalability
Availability
Heterogeneity Accommodation
Enterprise Service Management
Question C1 (5): How many consumers of services deployed by this system are expected?
YOU ARE EDITING PLANNED VALUES!
Web Services are not implemented in this system.
Unknown/estimated.
Empirical evidence shows that the system can support the expected number of consumers.
The system has been formally tested to meet the service level as defined in the specifications and is capable of scaling to meet excess demand.
The system includes automatic detection of increased usage and will automatically increase capacity without human intervention.
< previous question
next question >
end assessment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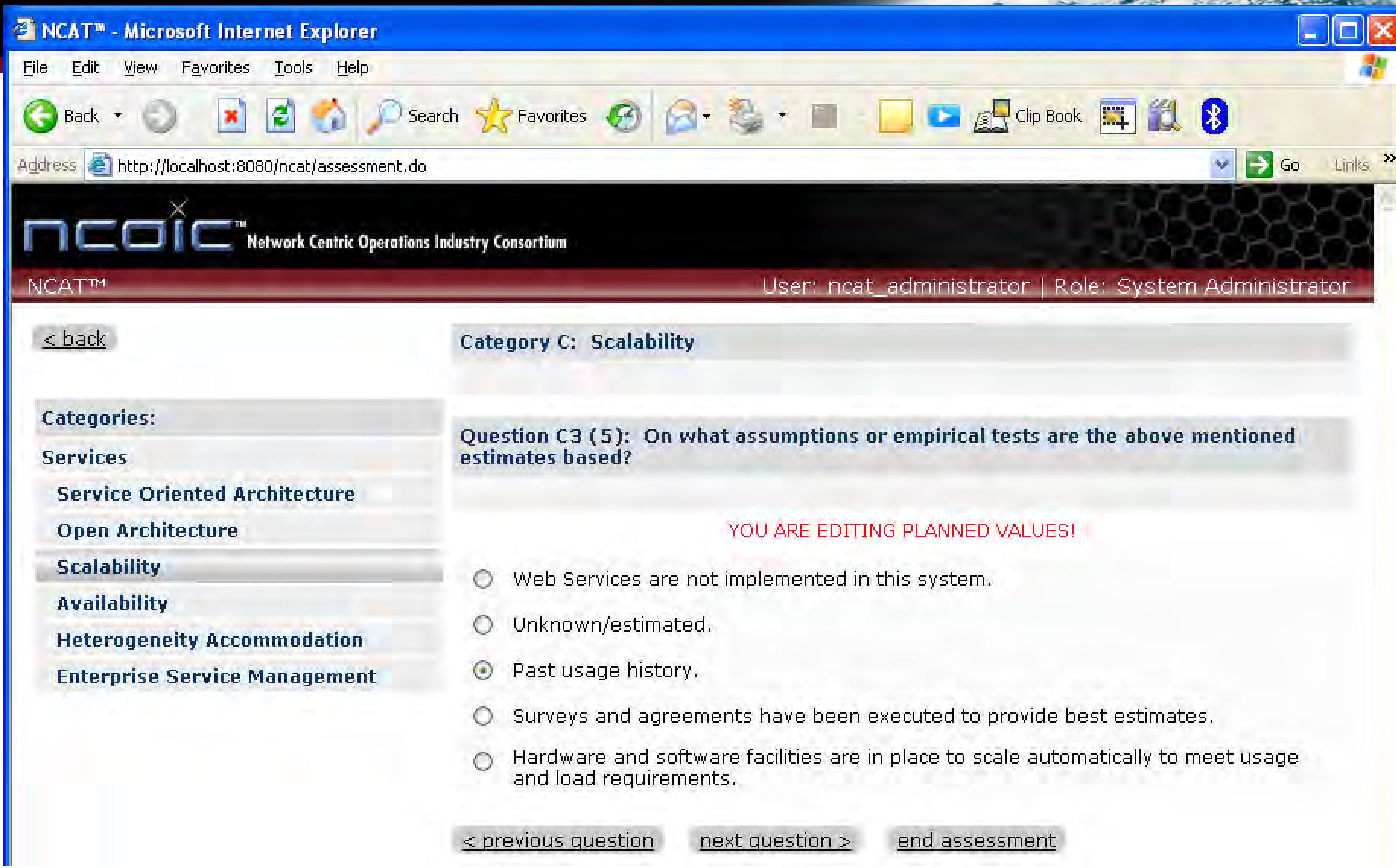
Category C: Scalability
Categories:
Services
Service Oriented Architecture
Open Architecture
Scalability
Availability
Heterogeneity Accommodation
Enterprise Service Management
Question C2 (5): How many service invocations of services deployed by this system per hour (or per some appropriate unit of time) are expected?
YOU ARE EDITING PLANNED VALUES!
Web Services are not implemented in this system.
Unknown/estimated.
Empirical evidence shows that the system can support the expected number of service invocations.
The system has been formally tested to meet the service level as defined in the specifications and is capable of scaling to meet excess demand.
The system includes automatic detection of increased service load and will automatically increase capacity without human intervention.
< previous question
next question >
end assessment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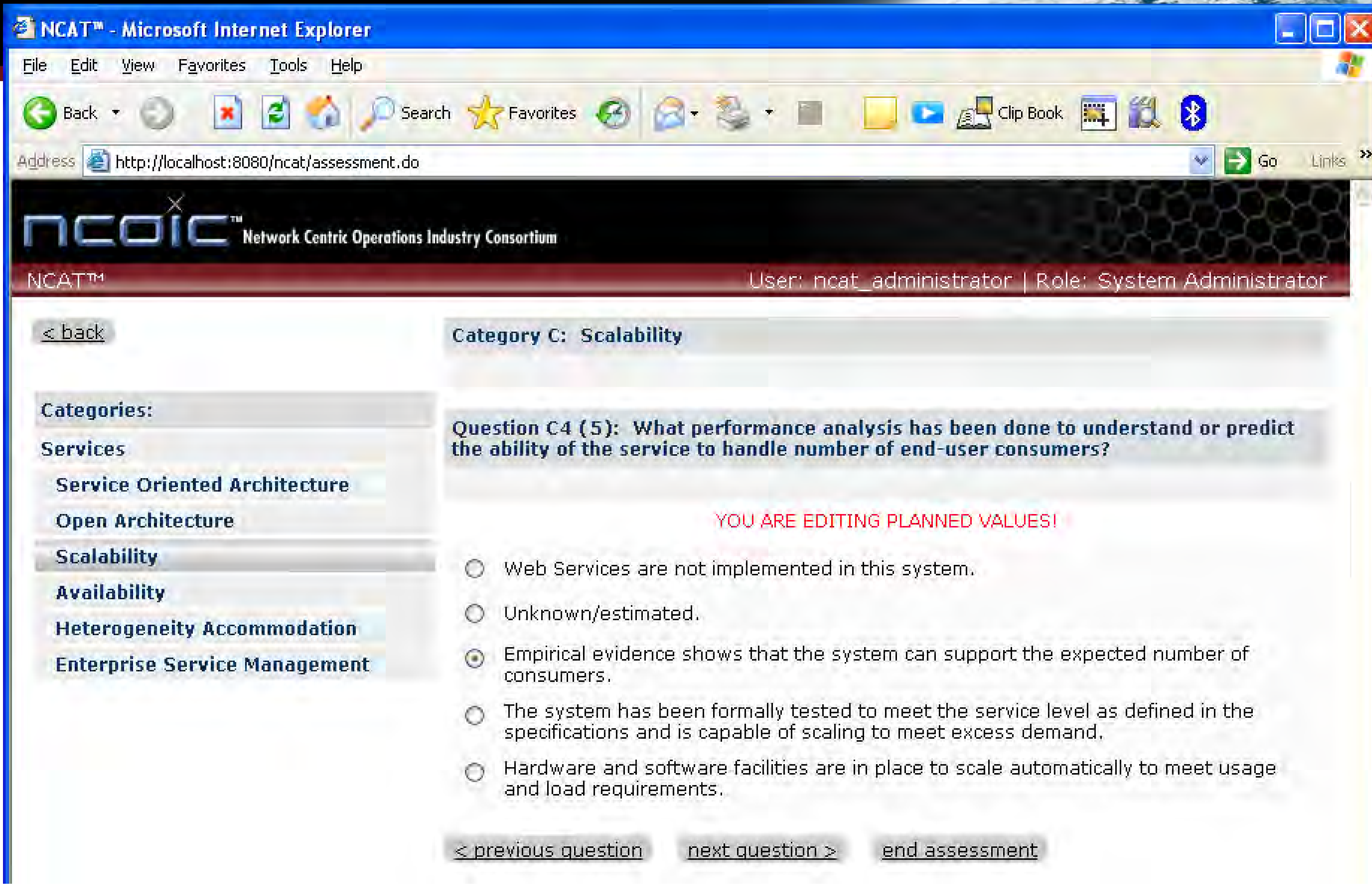
Category C: Scalability
Categories:
Services
Service Oriented Architecture
Open Architecture
Scalability
Availability
Heterogeneity Accommodation
Enterprise Service Management
Question C3 (5): On what assumptions or empirical tests are the above mentioned estimates based?
YOU ARE EDITING PLANNED VALUES!
Web Services are not implemented in this system.
Unknown/estimated.
Past usage history.
Surveys and agreements have been executed to provide best estimates.
Hardware and software facilities are in place to scale automatically to meet usage and load requirements.
< previous question
next question >
end assessment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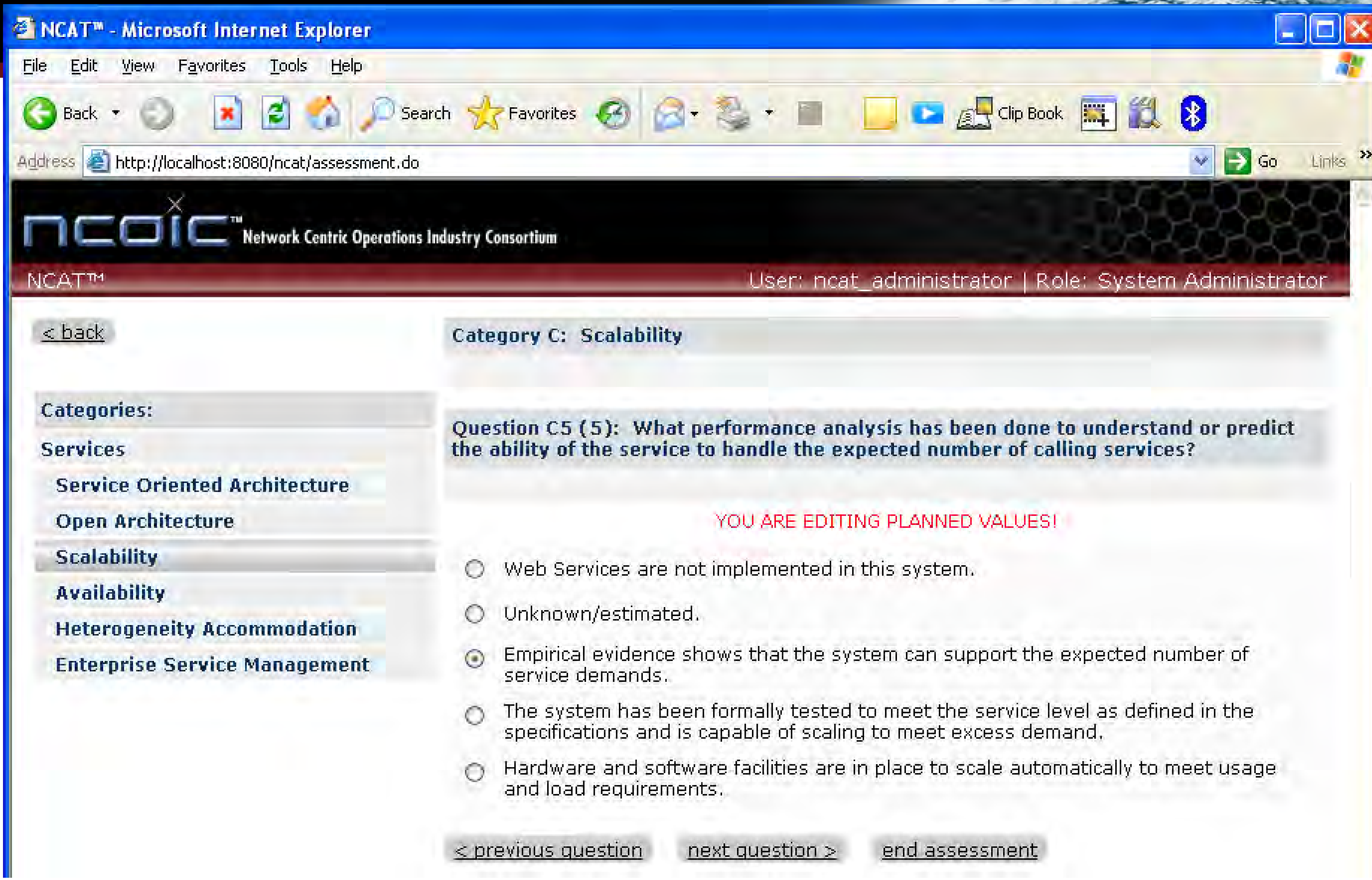
Category C: Scalability
Categories:
Services
Service Oriented Architecture
Open Architecture
Scalability
Availability
Heterogeneity Accommodation
Enterprise Service Management
Question C4 (5): What performance analysis has been done to understand or predict the ability of the service to handle number of end-user consumers?
YOU ARE EDITING PLANNED VALUES!
Web Services are not implemented in this system.
Unknown/estimated.
Empirical evidence shows that the system can support the expected number of consumers.
The system has been formally tested to meet the service level as defined in the specifications and is capable of scaling to meet excess demand.
Hardware and software facilities are in place to scale automatically to meet usage and load requirements.
< previous question
next question >
end assessment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Category C: Scalability
Categories:
Services
Service Oriented Architecture
Open Architecture
Scalability
Availability
Heterogeneity Accommodation
Enterprise Service Management
Question C5 (5): What performance analysis has been done to understand or predict the ability of the service to handle the expected number of calling services?
YOU ARE EDITING PLANNED VALUES!
Web Services are not implemented in this system.
Unknown/estimated.
Empirical evidence shows that the system can support the expected number of service demands.
The system has been formally tested to meet the service level as defined in the specifications and is capable of scaling to meet excess demand.
Hardware and software facilities are in place to scale automatically to meet usage and load requirements.
< previous question
next question >
end assessment

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Categories:

Services

Service Oriented Architecture

D. **Open Architecture**

Scalability

Availability

Heterogeneity Accommodation

Enterprise Service Management

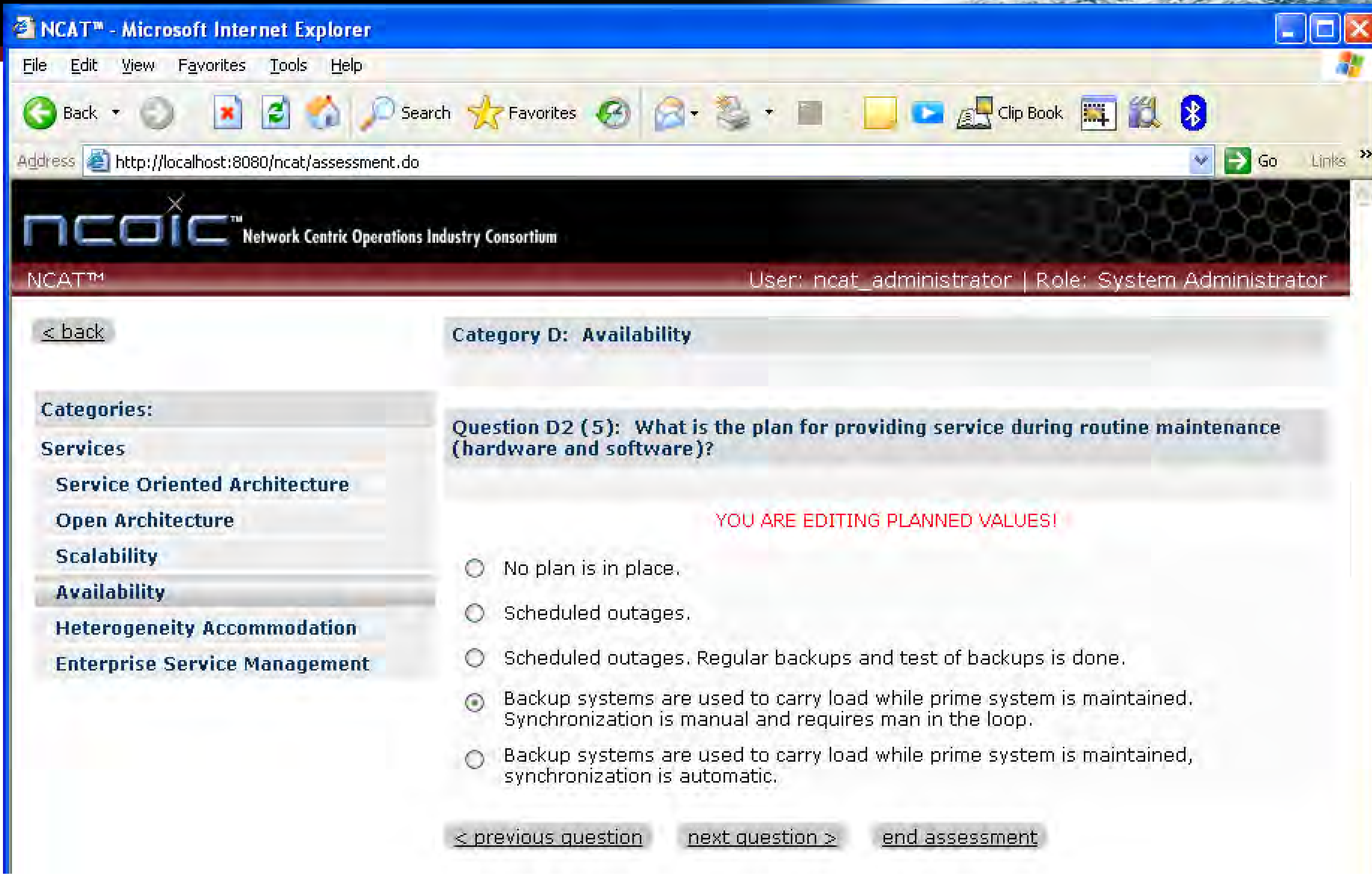
Category D: Availability

Question D1 (5): Does the program have a continuity of operations plan?

YOU ARE EDITING PLANNED VALUES!

- No plan is in place.
- Basic plan allows for MTBF and MTB recovery. No testing plan is in place.
- Basic plan allows for MTBF and MTB recovery. Testing plan is in place and exercised regularly.
- A continuity plan is in place to assure minimal MTBR including regular backups and testing.
- A fault tolerant continuity of operations plan is in place and it is exercised on a regular basis with contingency operations also verified.

< previous question next question > end assessment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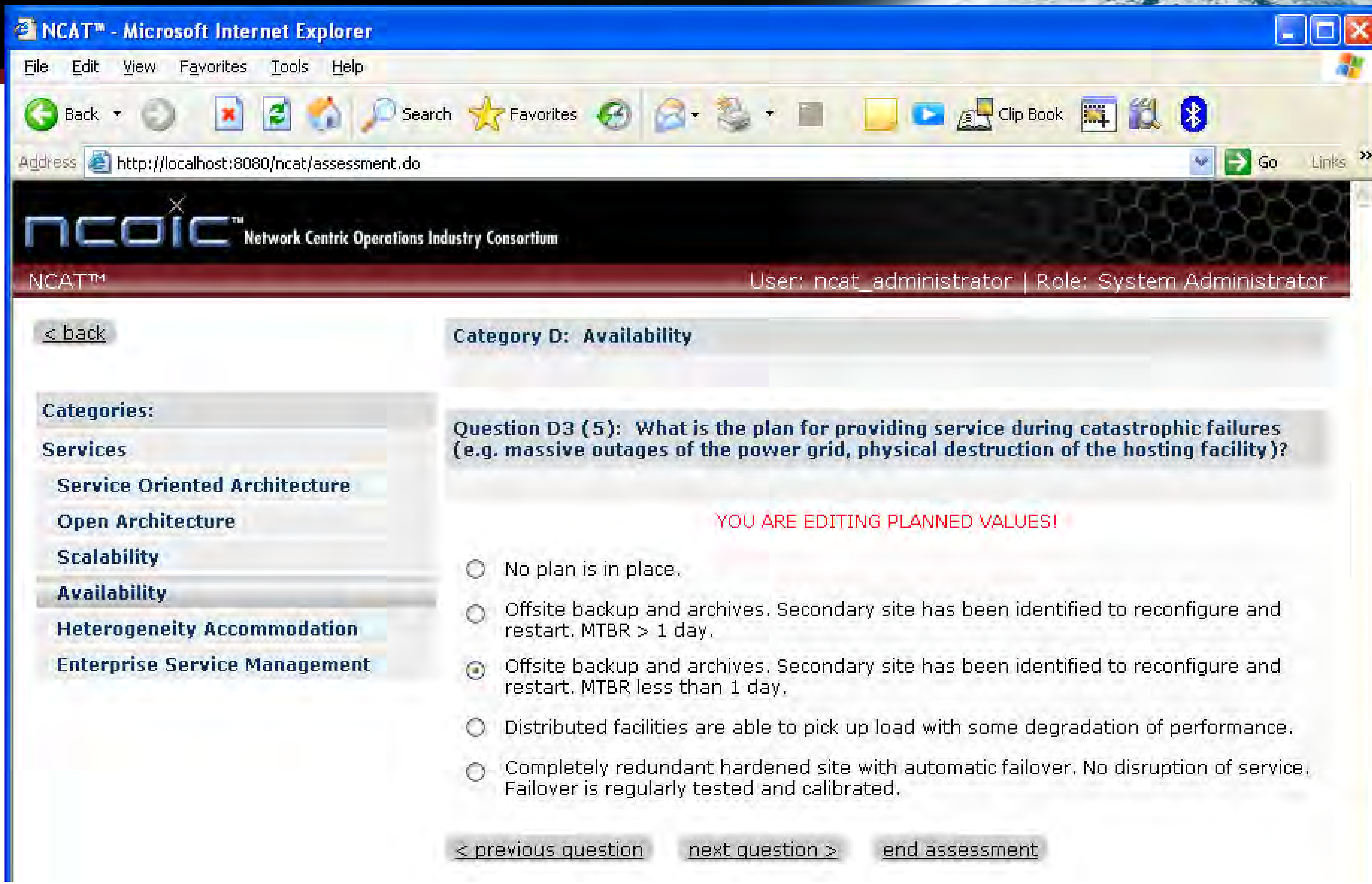
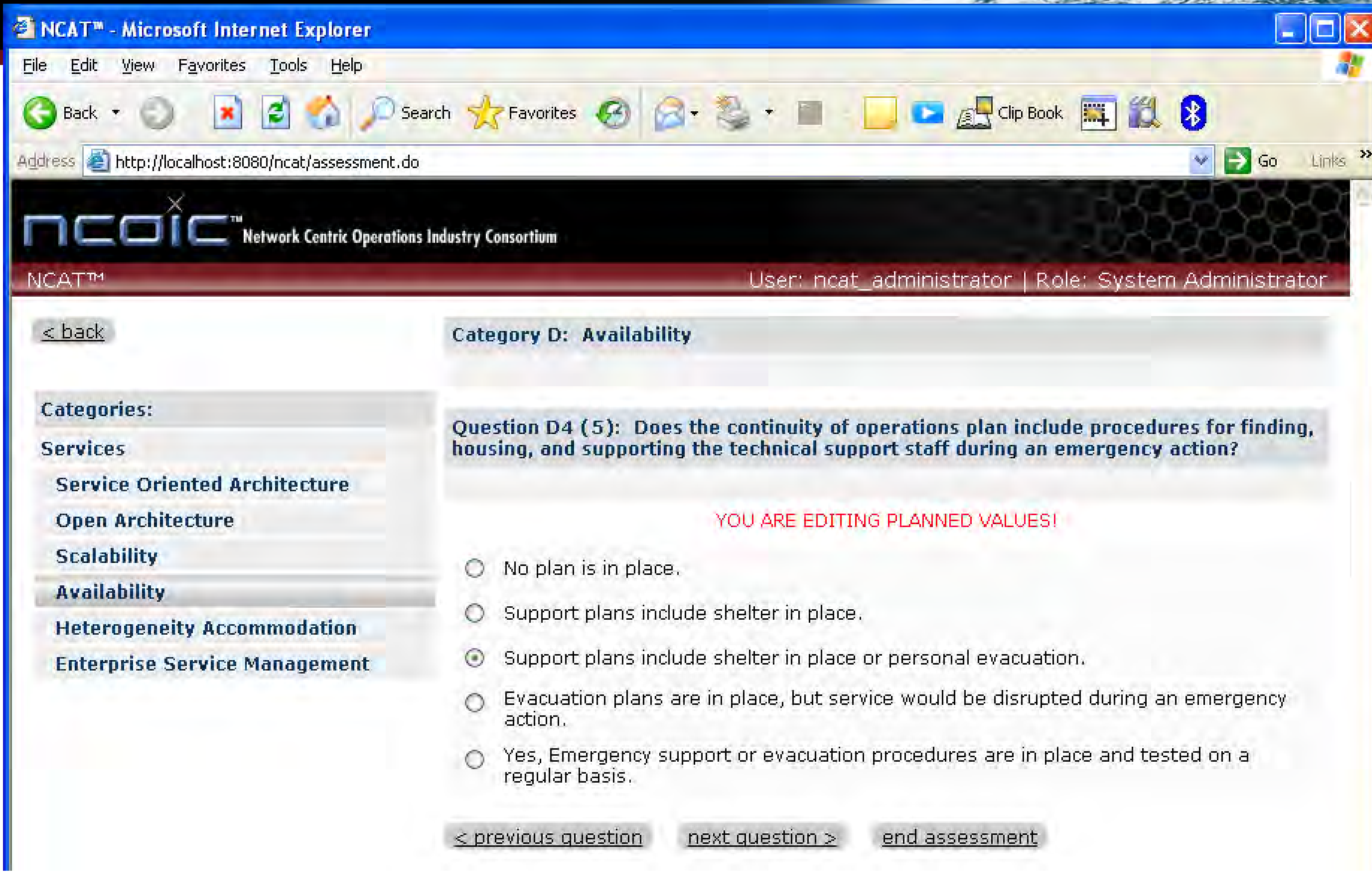
Category D: Availability
Categories:
Services
Service Oriented Architecture
Open Architecture
Scalability
Availability
Heterogeneity Accommodation
Enterprise Service Management
Question D2 (5): What is the plan for providing service during routine maintenance (hardware and software)?
YOU ARE EDITING PLANNED VALUES!
No plan is in place.
Scheduled outages.
Scheduled outages. Regular backups and test of backups is done.
Backup systems are used to carry load while prime system is maintained. Synchronization is manual and requires man in the loop.
Backup systems are used to carry load while prime system is maintained, synchronization is automatic.
< previous question
next question >
end assessment


NCAT™ - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Clip Book
Address http://localhost:8080/ncat/assessment.do
Go Links
ncoic™ Network Centric Operations Industry Consortium
NCAT™
User: ncat_administrator | Role: System Administrator
< back
Category D: Availability
Categories:
Services
Service Oriented Architecture
Open Architecture
Scalability
Availability
Heterogeneity Accommodation
Enterprise Service Management
Question D3 (5): What is the plan for providing service during catastrophic failures (e.g. massive outages of the power grid, physical destruction of the hosting facility)?
YOU ARE EDITING PLANNED VALUES!
No plan is in place.
Offsite backup and archives. Secondary site has been identified to reconfigure and restart. MTBR > 1 day.
Offsite backup and archives. Secondary site has been identified to reconfigure and restart. MTBR less than 1 day.
Distributed facilities are able to pick up load with some degradation of performance.
Completely redundant hardened site with automatic failover. No disruption of service. Failover is regularly tested and calibrated.
< previous question
next question >
end assessment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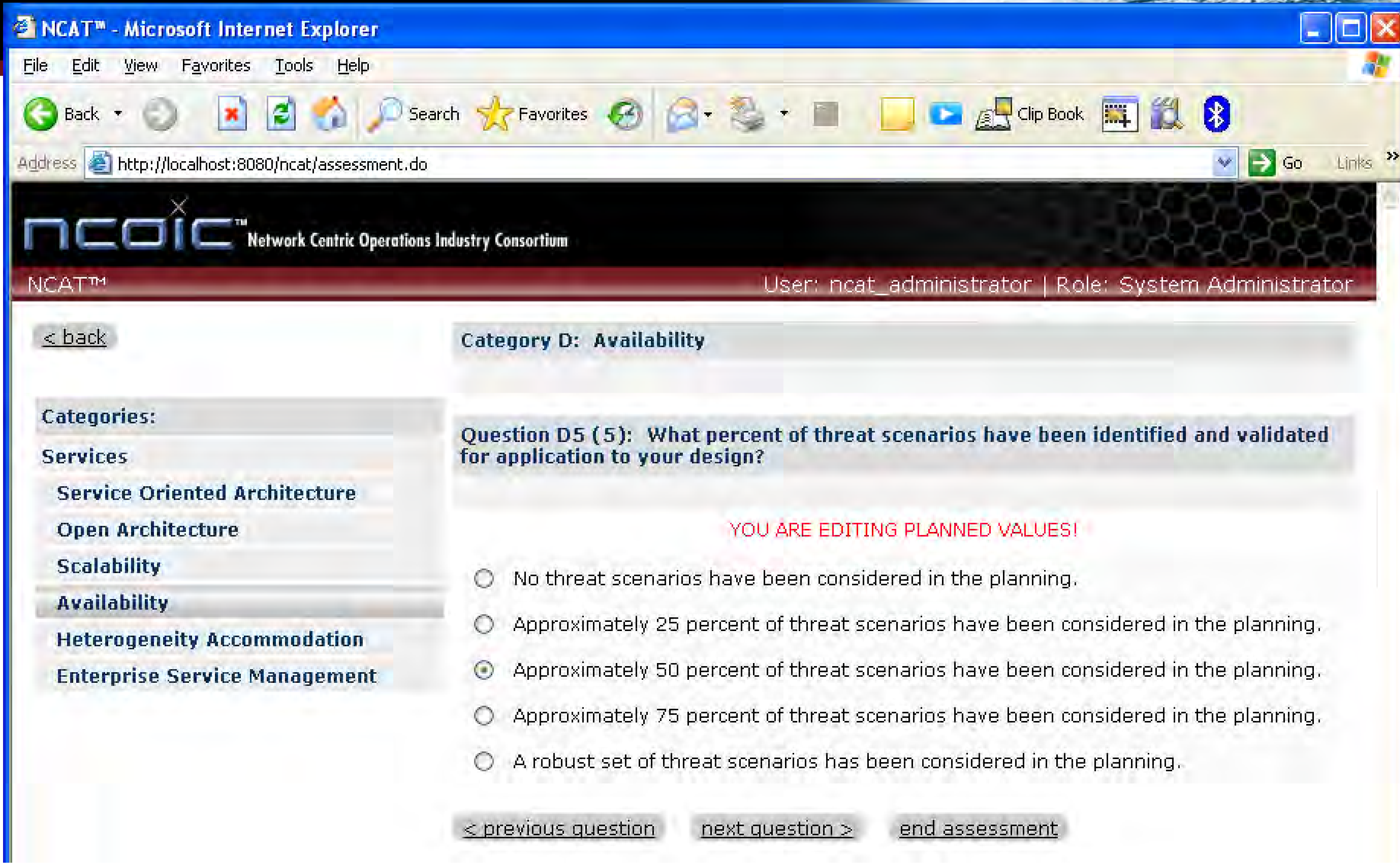
NCAT™
User: ncat_administrator | Role: System Administrator
< back
Category D: Availability
Categories:
Services
Service Oriented Architecture
Open Architecture
Scalability
Availability
Heterogeneity Accommodation
Enterprise Service Management
Question D4 (5): Does the continuity of operations plan include procedures for finding, housing, and supporting the technical support staff during an emergency action?
YOU ARE EDITING PLANNED VALUES!
No plan is in place.
Support plans include shelter in place.
Support plans include shelter in place or personal evacuation.
Evacuation plans are in place, but service would be disrupted during an emergency action.
Yes, Emergency support or evacuation procedures are in place and tested on a regular basis.
< previous question
next question >
end assessment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NCAT™
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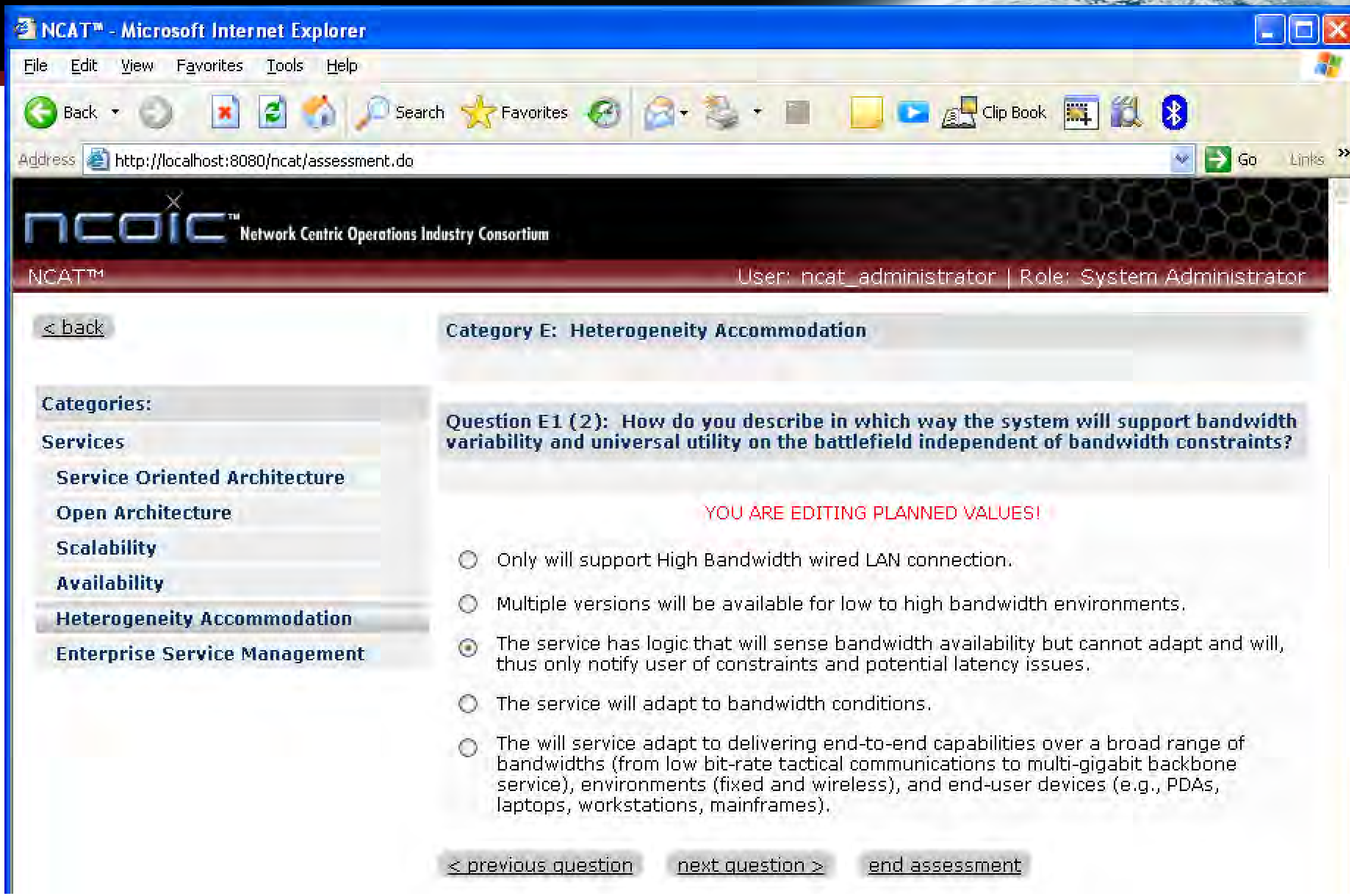
< back
Category D: Availability
Categories:
Services
Service Oriented Architecture
Open Architecture
Scalability
Availability
Heterogeneity Accommodation
Enterprise Service Management
Question D5 (5): What percent of threat scenarios have been identified and validated for application to your design?
YOU ARE EDITING PLANNED VALUES!
No threat scenarios have been considered in the planning.
Approximately 25 percent of threat scenarios have been considered in the planning.
Approximately 50 percent of threat scenarios have been considered in the planning.
Approximately 75 percent of threat scenarios have been considered in the planning.
A robust set of threat scenarios has been considered in the planning.
< previous question
next question >
end assessment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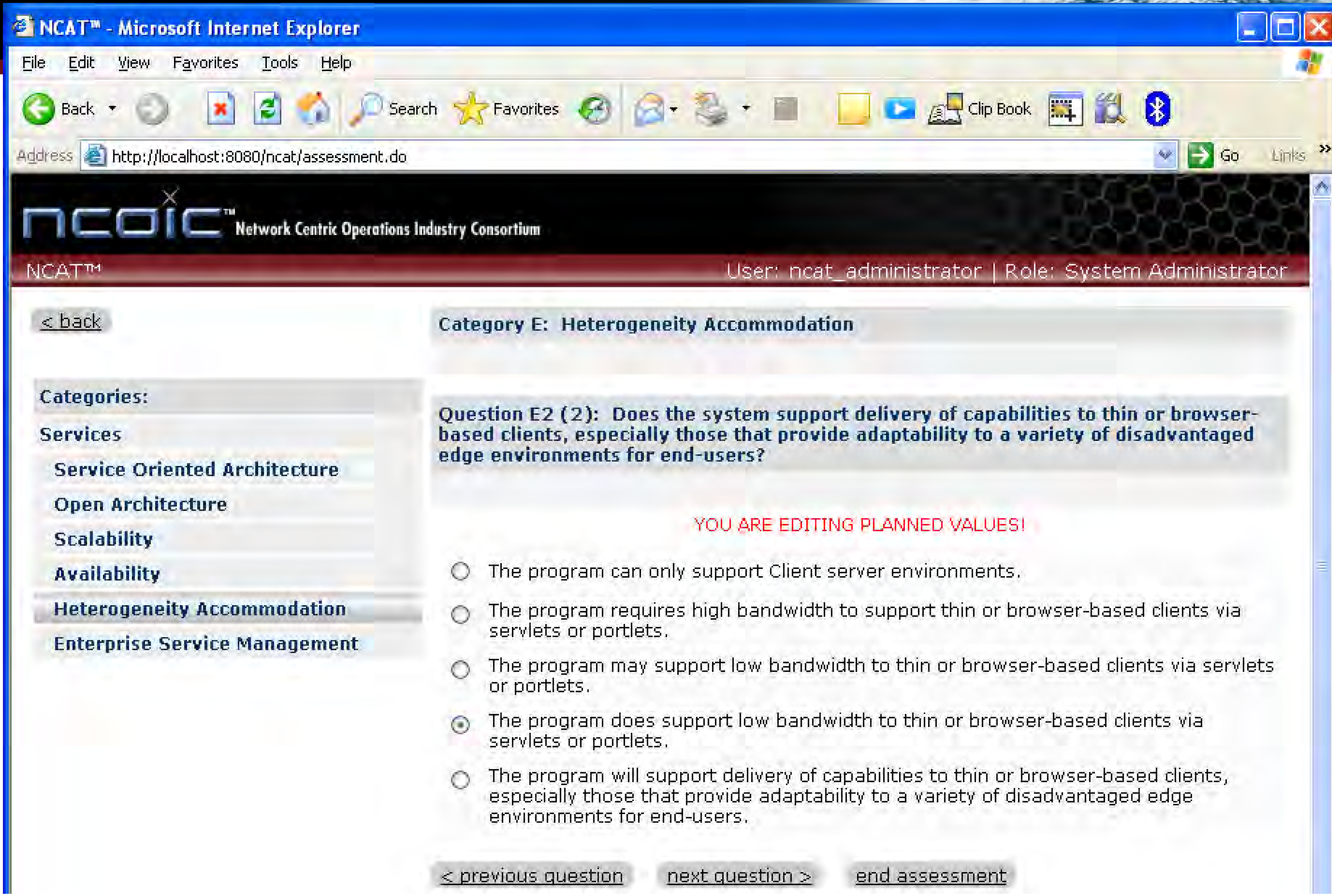
NCAT™
User: ncat_administrator | Role: System Administrator
< back
Category E: Heterogeneity Accommodation
Categories:
Services
Service Oriented Architecture
Open Architecture
Scalability
Availability
Heterogeneity Accommodation
Enterprise Service Management
Question E1 (2): How do you describe in which way the system will support bandwidth variability and universal utility on the battlefield independent of bandwidth constraints?
YOU ARE EDITING PLANNED VALUES!
Only will support High Bandwidth wired LAN connection.
Multiple versions will be available for low to high bandwidth environments.
The service has logic that will sense bandwidth availability but cannot adapt and will, thus only notify user of constraints and potential latency issues.
The service will adapt to bandwidth conditions.
The will service adapt to delivering end-to-end capabilities over a broad range of bandwidths (from low bit-rate tactical communications to multi-gigabit backbone service), environments (fixed and wireless), and end-user devices (e.g., PDAs, laptops, workstations, mainframes).
< previous question
next question >
end assessment



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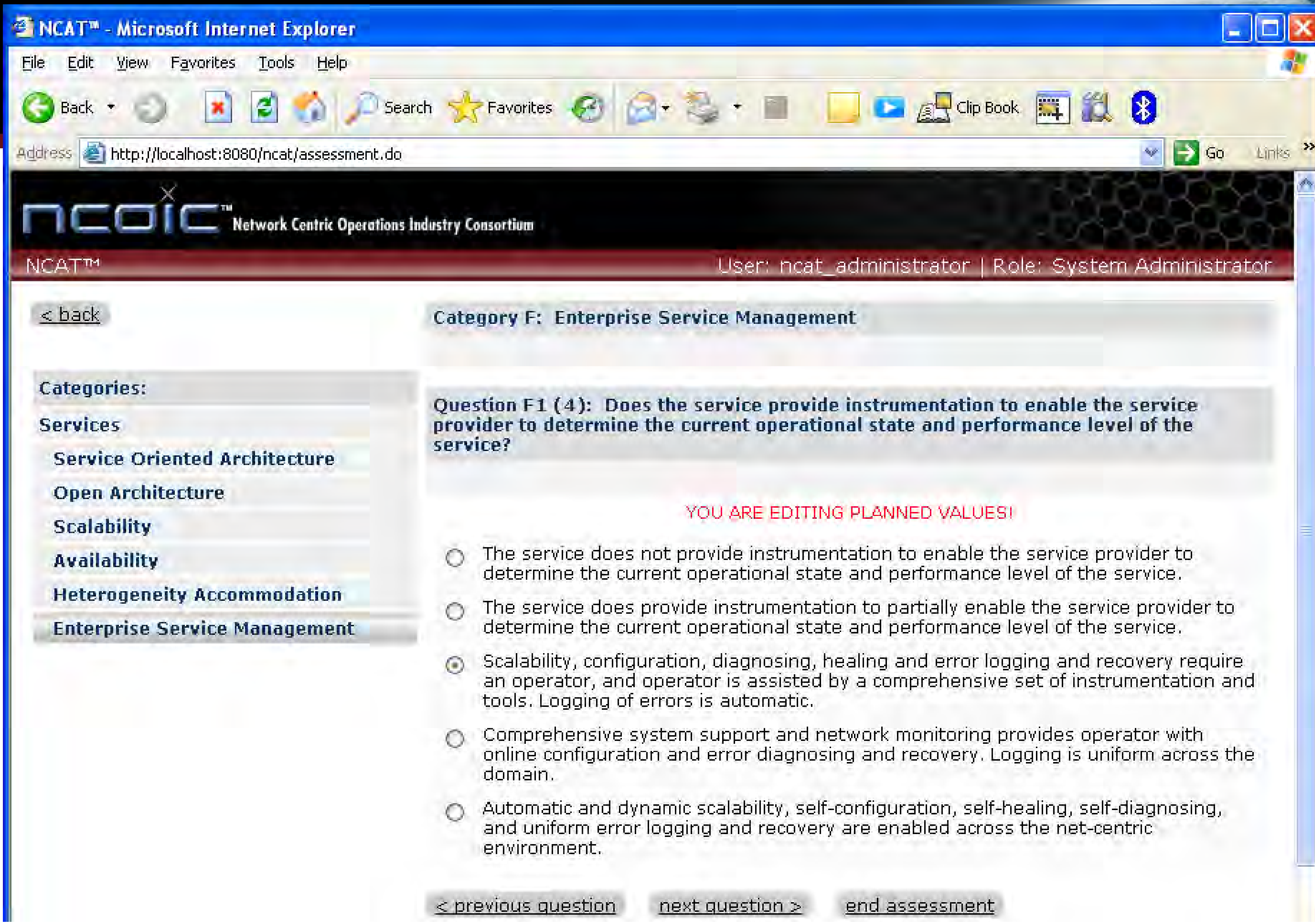
NCAT™
User: ncat_administrator | Role: System Administrator
< back
Category E: Heterogeneity Accommodation
Categories:
Services
Service Oriented Architecture
Open Architecture
Scalability
Availability
Heterogeneity Accommodation
Enterprise Service Management
Question E2 (2): Does the system support delivery of capabilities to thin or browser-based clients, especially those that provide adaptability to a variety of disadvantaged edge environments for end-users?
YOU ARE EDITING PLANNED VALUES!
The program can only support Client server environments.
The program requires high bandwidth to support thin or browser-based clients via servlets or portlets.
The program may support low bandwidth to thin or browser-based clients via servlets or portlets.
The program does support low bandwidth to thin or browser-based clients via servlets or portlets.
The program will support delivery of capabilities to thin or browser-based clients, especially those that provide adaptability to a variety of disadvantaged edge environments for end-users.
< previous question
next question >
end assessment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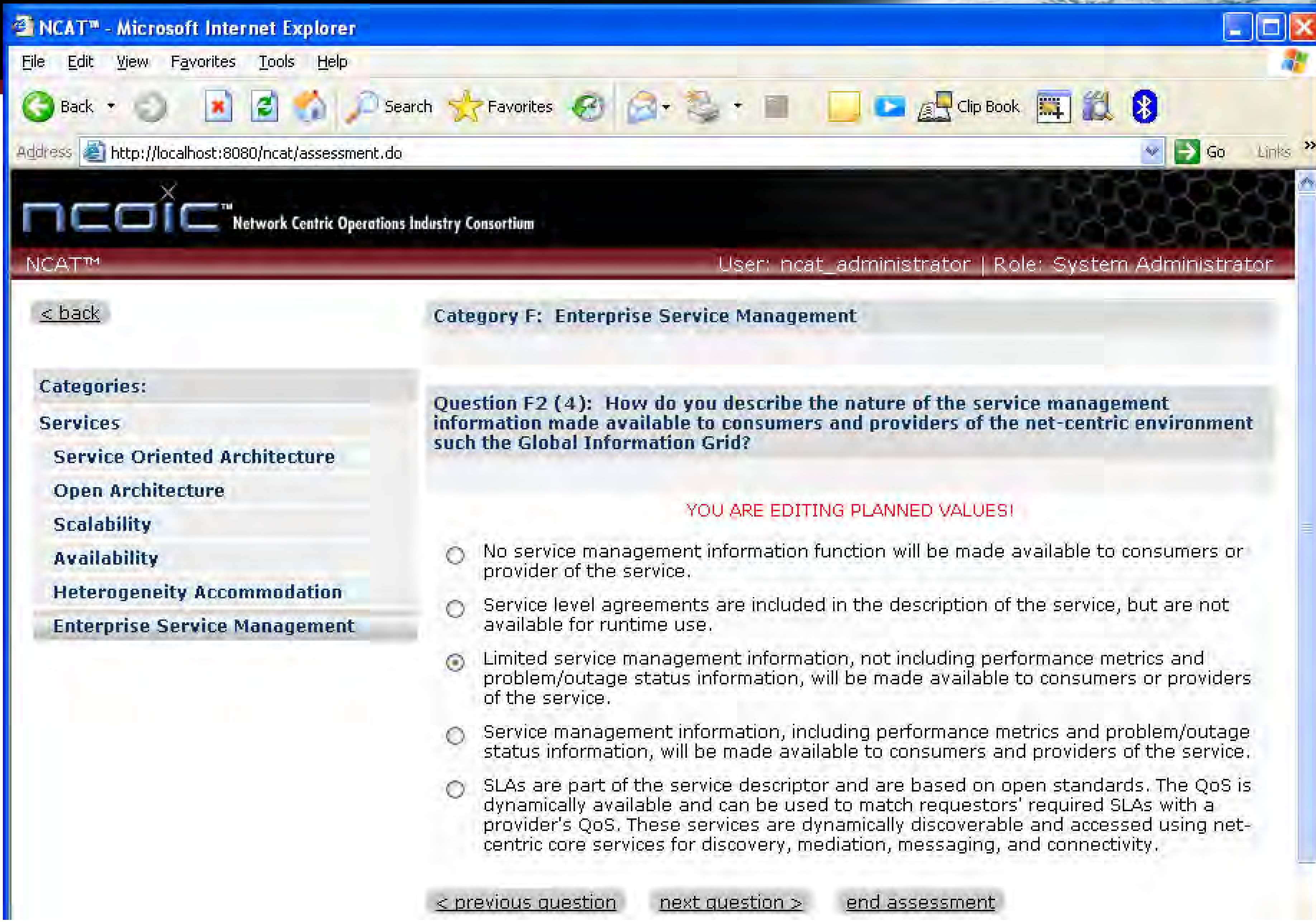
NCAT™
User: ncat_administrator | Role: System Administrator
< back
Category F: Enterprise Service Management
Categories:
Services
Service Oriented Architecture
Open Architecture
Scalability
Availability
Heterogeneity Accommodation
Enterprise Service Management
Question F1 (4): Does the service provide instrumentation to enable the service provider to determine the current operational state and performance level of the service?
YOU ARE EDITING PLANNED VALUES!
The service does not provide instrumentation to enable the service provider to determine the current operational state and performance level of the service.
The service does provide instrumentation to partially enable the service provider to determine the current operational state and performance level of the service.
Scalability, configuration, diagnosing, healing and error logging and recovery require an operator, and operator is assisted by a comprehensive set of instrumentation and tools. Logging of errors is automatic.
Comprehensive system support and network monitoring provides operator with online configuration and error diagnosing and recovery. Logging is uniform across the domain.
Automatic and dynamic scalability, self-configuration, self-healing, self-diagnosing, and uniform error logging and recovery are enabled across the net-centric environment.
< previous question
next question >
end assessment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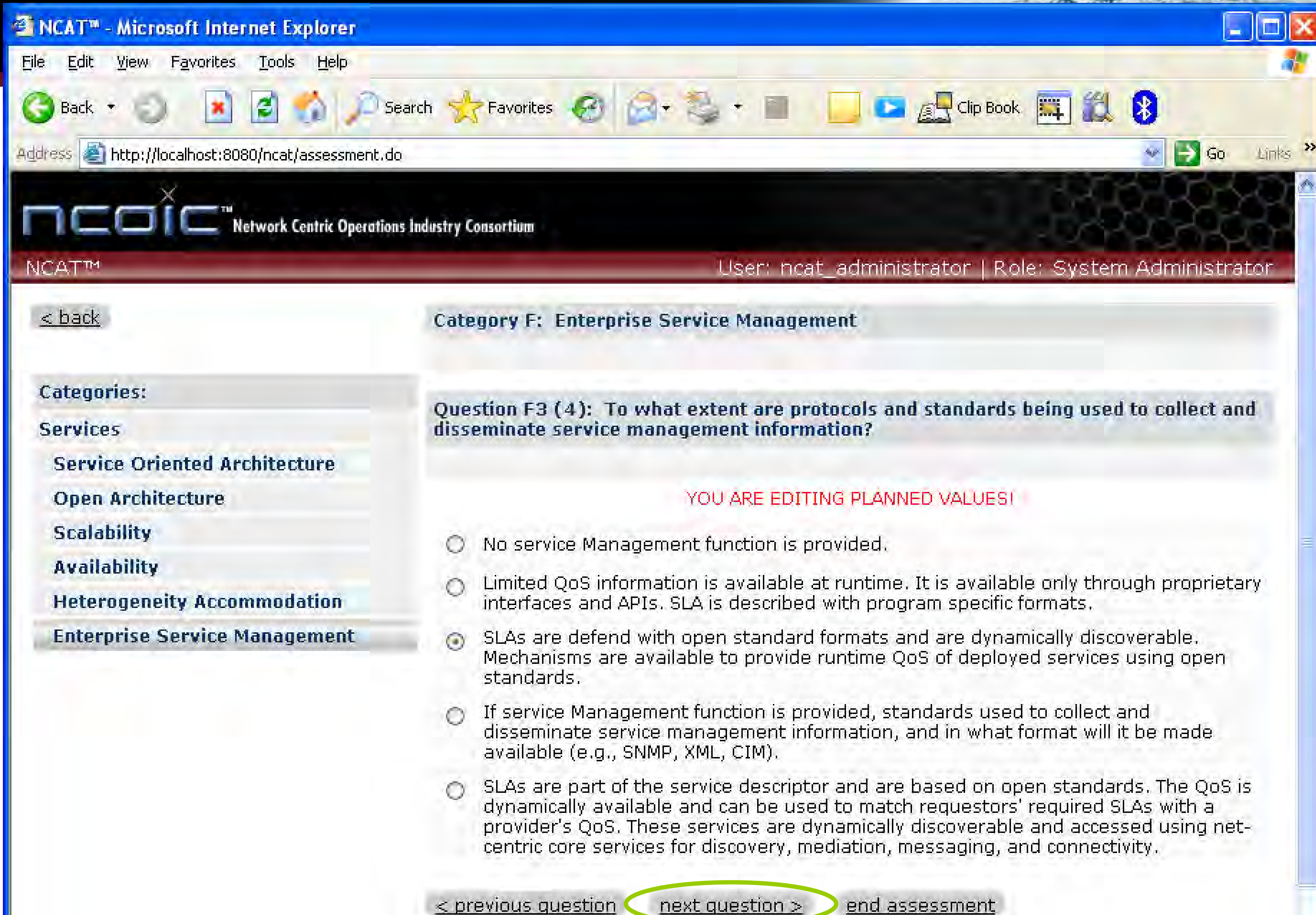
NCAT™
User: ncat_administrator | Role: System Administrator
< back
Category F: Enterprise Service Management
Categories:
Services
Service Oriented Architecture
Open Architecture
Scalability
Availability
Heterogeneity Accommodation
Enterprise Service Management
Question F2 (4): How do you describe the nature of the service management information made available to consumers and providers of the net-centric environment such the Global Information Grid?
YOU ARE EDITING PLANNED VALUES!
No service management information function will be made available to consumers or provider of the service.
Service level agreements are included in the description of the service, but are not available for runtime use.
Limited service management information, not including performance metrics and problem/outage status information, will be made available to consumers or providers of the service.
Service management information, including performance metrics and problem/outage status information, will be made available to consumers and providers of the service.
SLAs are part of the service descriptor and are based on open standards. The QoS is dynamically available and can be used to match requestors' required SLAs with a provider's QoS. These services are dynamically discoverable and accessed using net-centric core services for discovery, mediation, messaging, and connectivity.
< previous question
next question >
end assessment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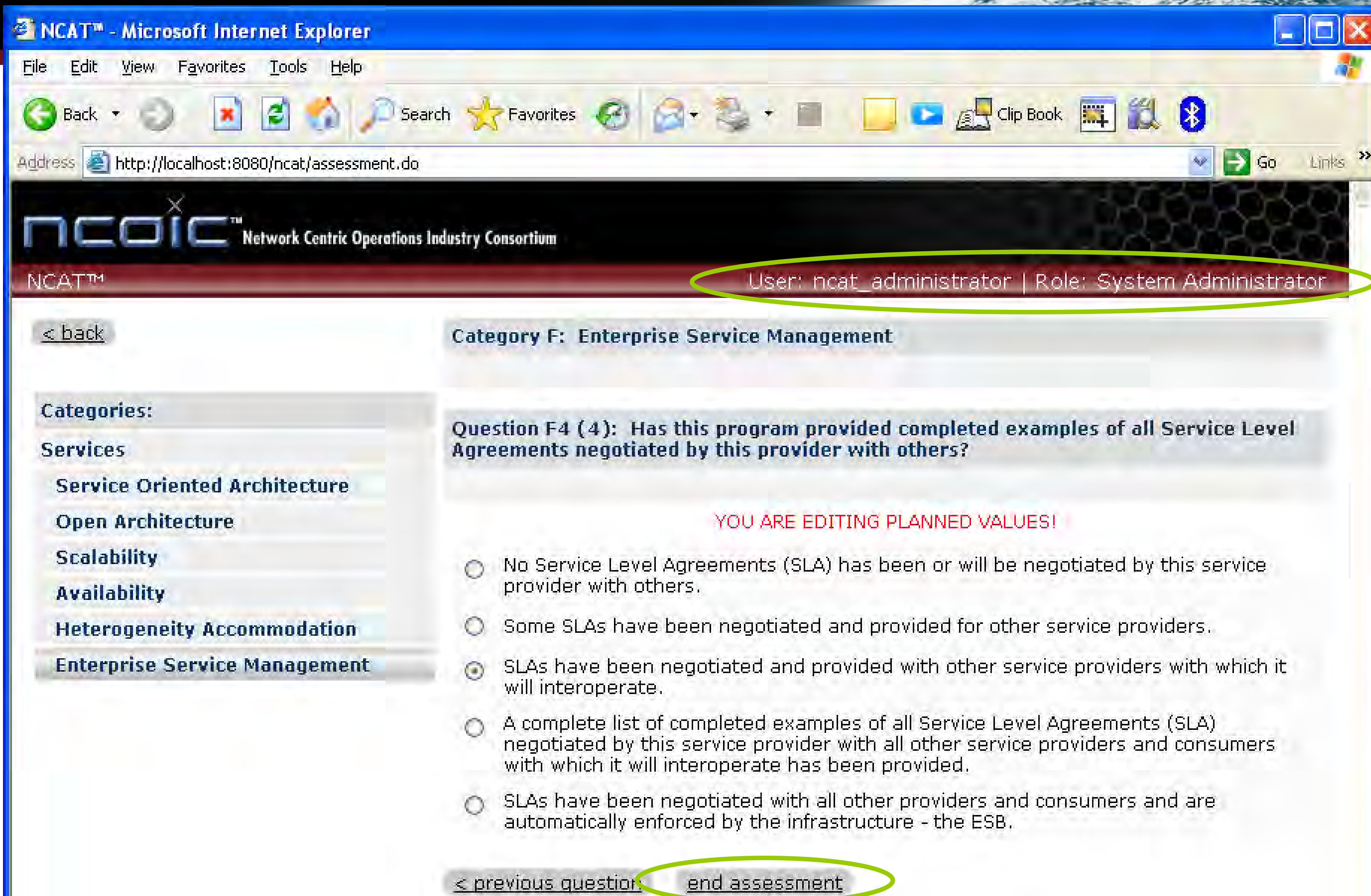
NCAT™
User: ncat_administrator | Role: System Administrator
< back
Category F: Enterprise Service Management
Categories:
Services
Service Oriented Architecture
Open Architecture
Scalability
Availability
Heterogeneity Accommodation
Enterprise Service Management
Question F3 (4): To what extent are protocols and standards being used to collect and disseminate service management information?
YOU ARE EDITING PLANNED VALUES!
No service Management function is provided.
Limited QoS information is available at runtime. It is available only through proprietary interfaces and APIs. SLA is described with program specific formats.
SLAs are defend with open standard formats and are dynamically discoverable. Mechanisms are available to provide runtime QoS of deployed services using open standards.
If service Management function is provided, standards used to collect and disseminate service management information, and in what format will it be made available (e.g., SNMP, XML, CIM).
SLAs are part of the service descriptor and are based on open standards. The QoS is dynamically available and can be used to match requestors' required SLAs with a provider's QoS. These services are dynamically discoverable and accessed using net-centric core services for discovery, mediation, messaging, and connectivity.
< previous question
next question >
end assessment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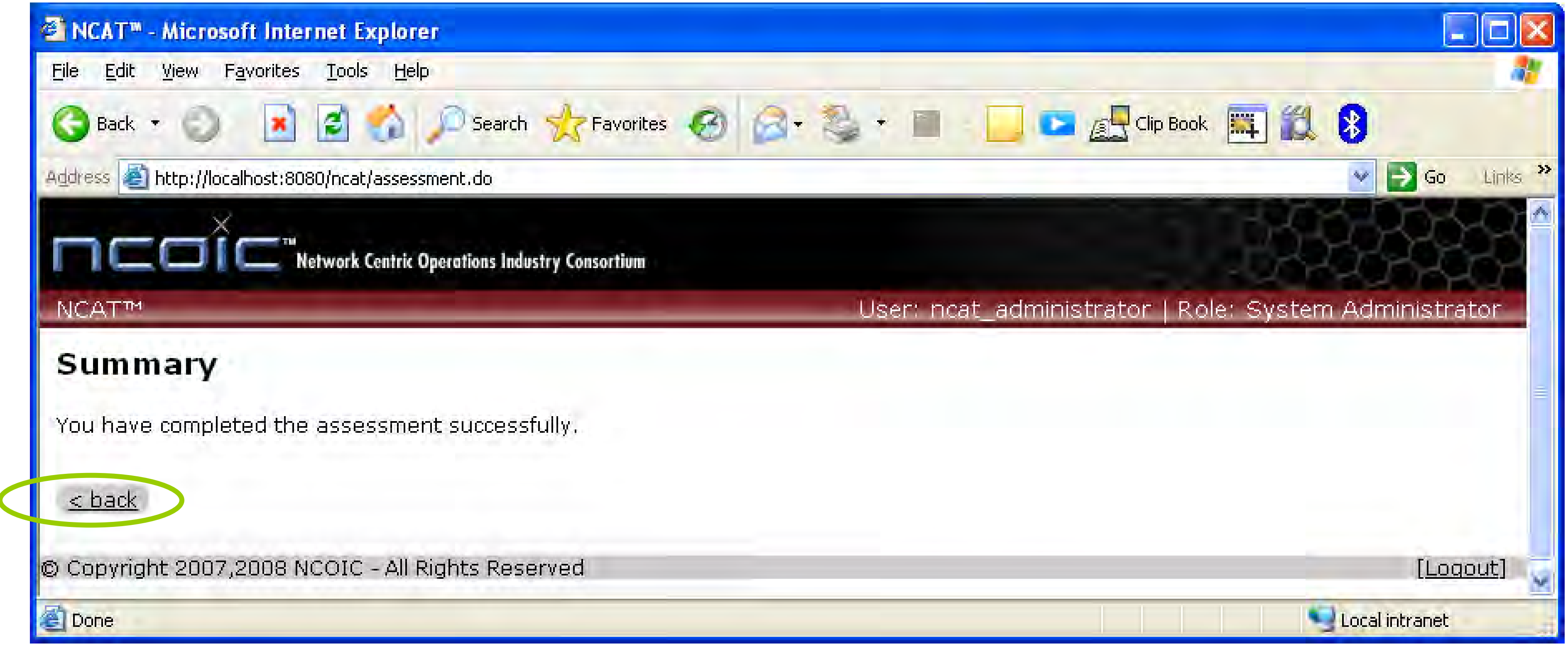
NCAT™
User: ncat_administrator | Role: System Administrator
< back
Category F: Enterprise Service Management
Categories:
Services
Service Oriented Architecture
Open Architecture
Scalability
Availability
Heterogeneity Accommodation
Enterprise Service Management
Question F4 (4): Has this program provided completed examples of all Service Level Agreements negotiated by this provider with others?
YOU ARE EDITING PLANNED VALUES!
No Service Level Agreements (SLA) has been or will be negotiated by this service provider with others.
Some SLAs have been negotiated and provided for other service providers.
SLAs have been negotiated and provided with other service providers with which it will interoperate.
A complete list of completed examples of all Service Level Agreements (SLA) negotiated by this service provider with all other service providers and consumers with which it will interoperate has been provided.
SLAs have been negotiated with all other providers and consumers and are automatically enforced by the infrastructure - the ESB.
< previous question
end assessment

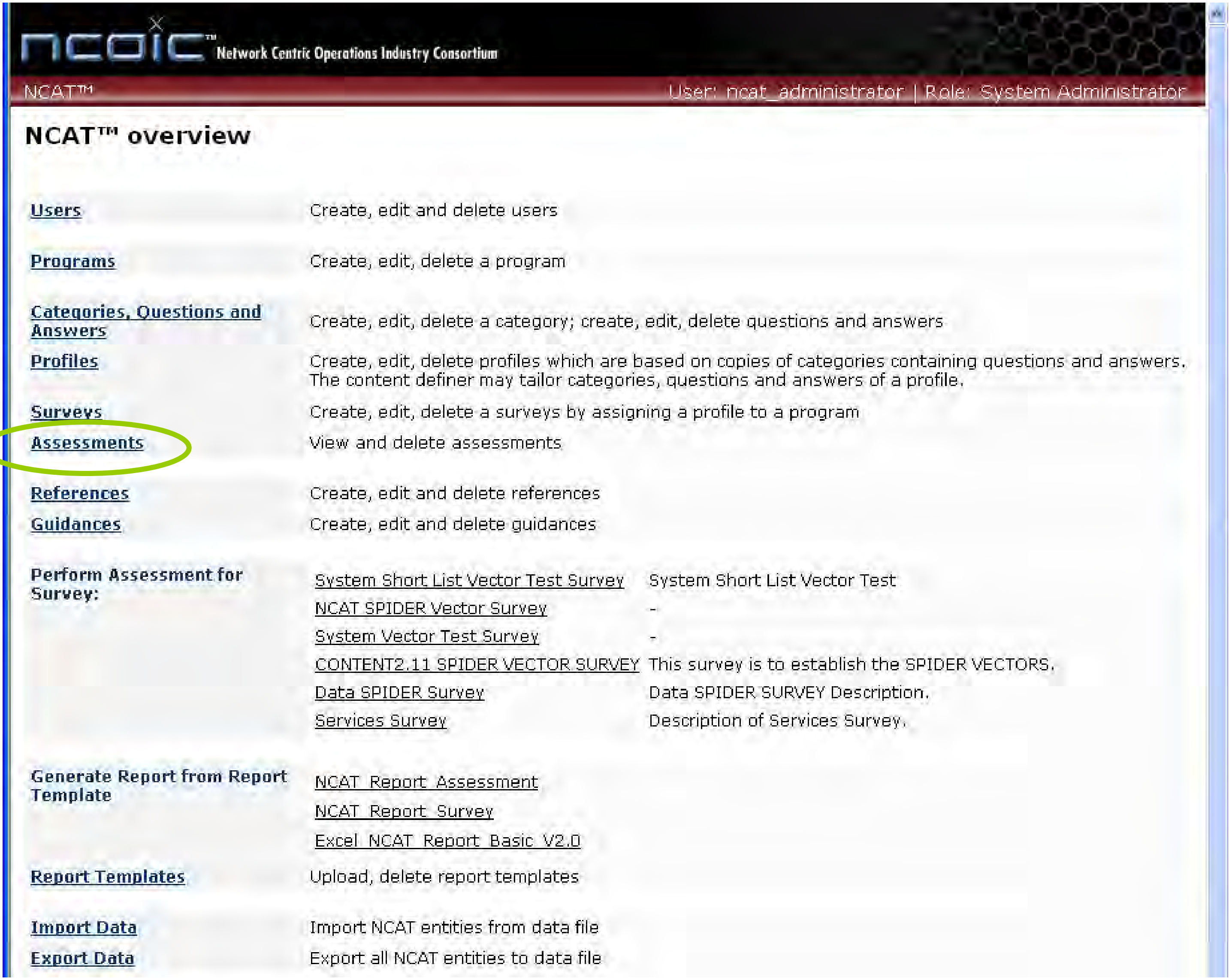
End Assessment Returns you to the Summary

- Click “Back” takes you to “Home”
- Note the Assessment is not complete, just the setting of the Planned Values



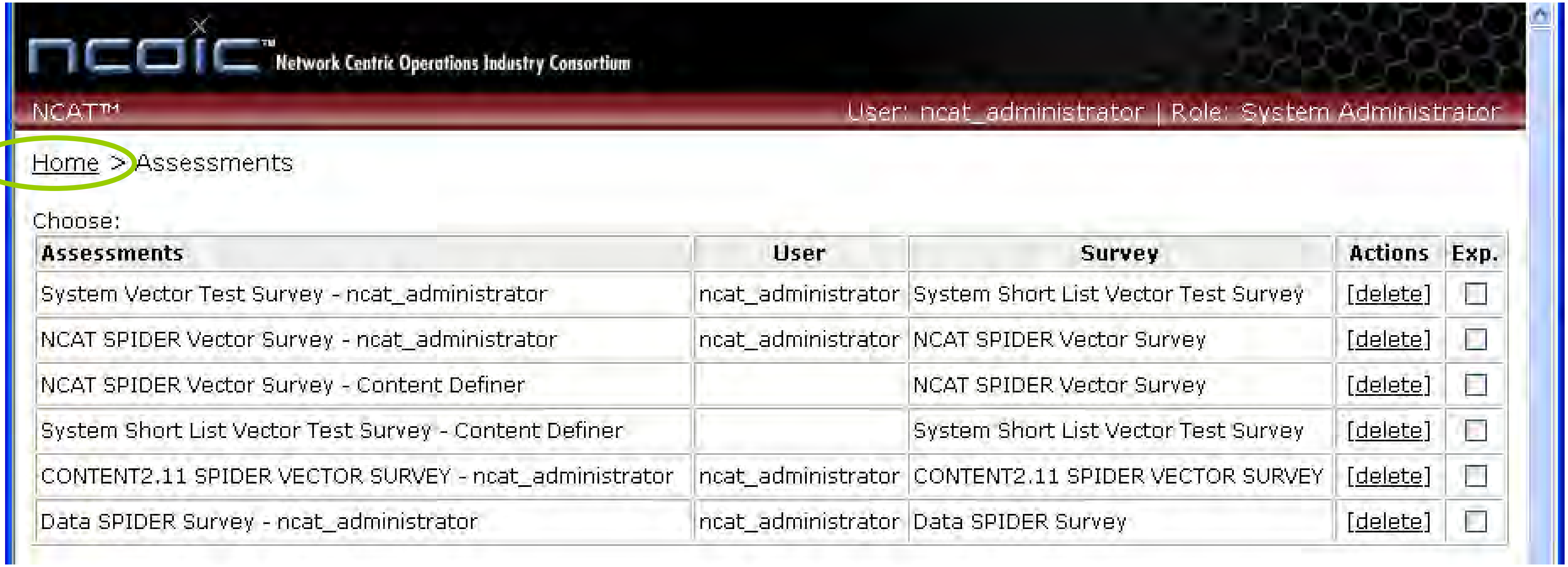
Back to “Home”

- Click on “Assessments”
- Observe if any assessments are visible for “Services”



No Assessments visible for Services

- “Services Assessment” has not been created at this time
- Click on “Home”



Network Centric Operations Industry Consortium

NCAT™ User: ncat_administrator | Role: System Administrator

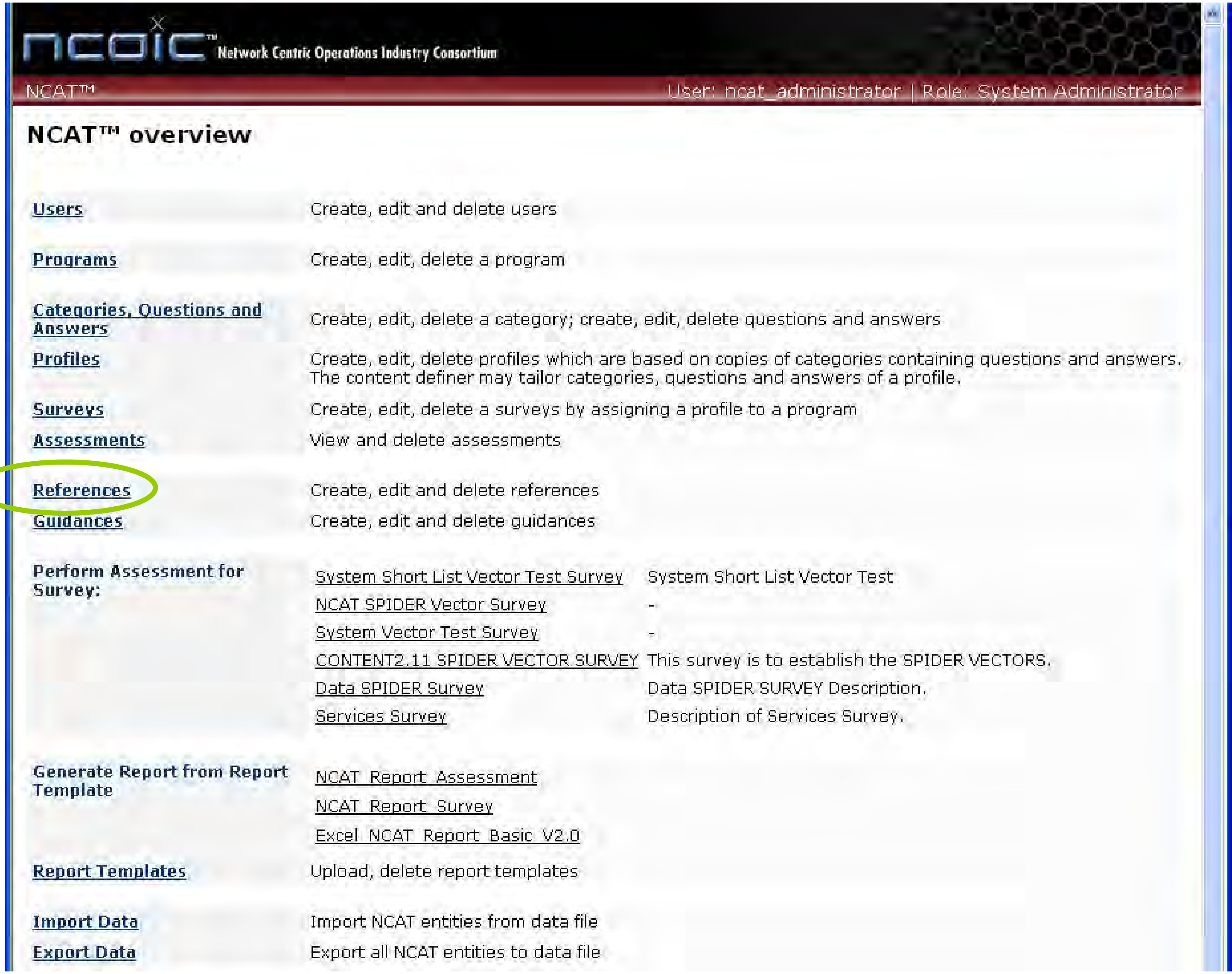
Home > Assessments

Choose:

Assessments	User	Survey	Actions	Exp.
System Vector Test Survey - ncat_administrator	ncat_administrator	System Short List Vector Test Survey	[delete]	
NCAT SPIDER Vector Survey - ncat_administrator	ncat_administrator	NCAT SPIDER Vector Survey	[delete]	
NCAT SPIDER Vector Survey - Content Definer		NCAT SPIDER Vector Survey	[delete]	
System Short List Vector Test Survey - Content Definer		System Short List Vector Test Survey	[delete]	
CONTENT2.11 SPIDER VECTOR SURVEY - ncat_administrator	ncat_administrator	CONTENT2.11 SPIDER VECTOR SURVEY	[delete]	
Data SPIDER Survey - ncat_administrator	ncat_administrator	Data SPIDER Survey	[delete]	

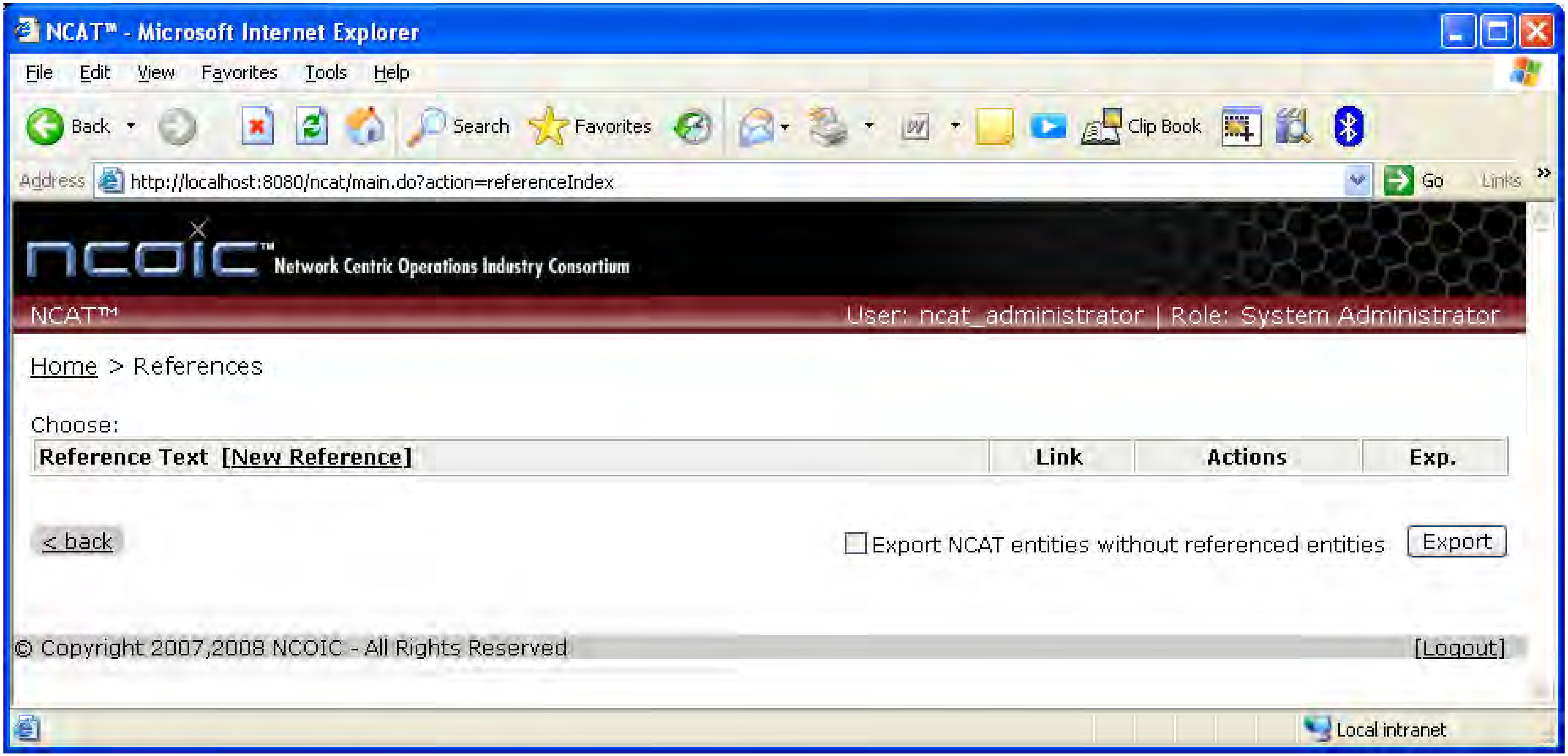
See if any "References" are defined

- Click on "References"
- Observe if any references are visible



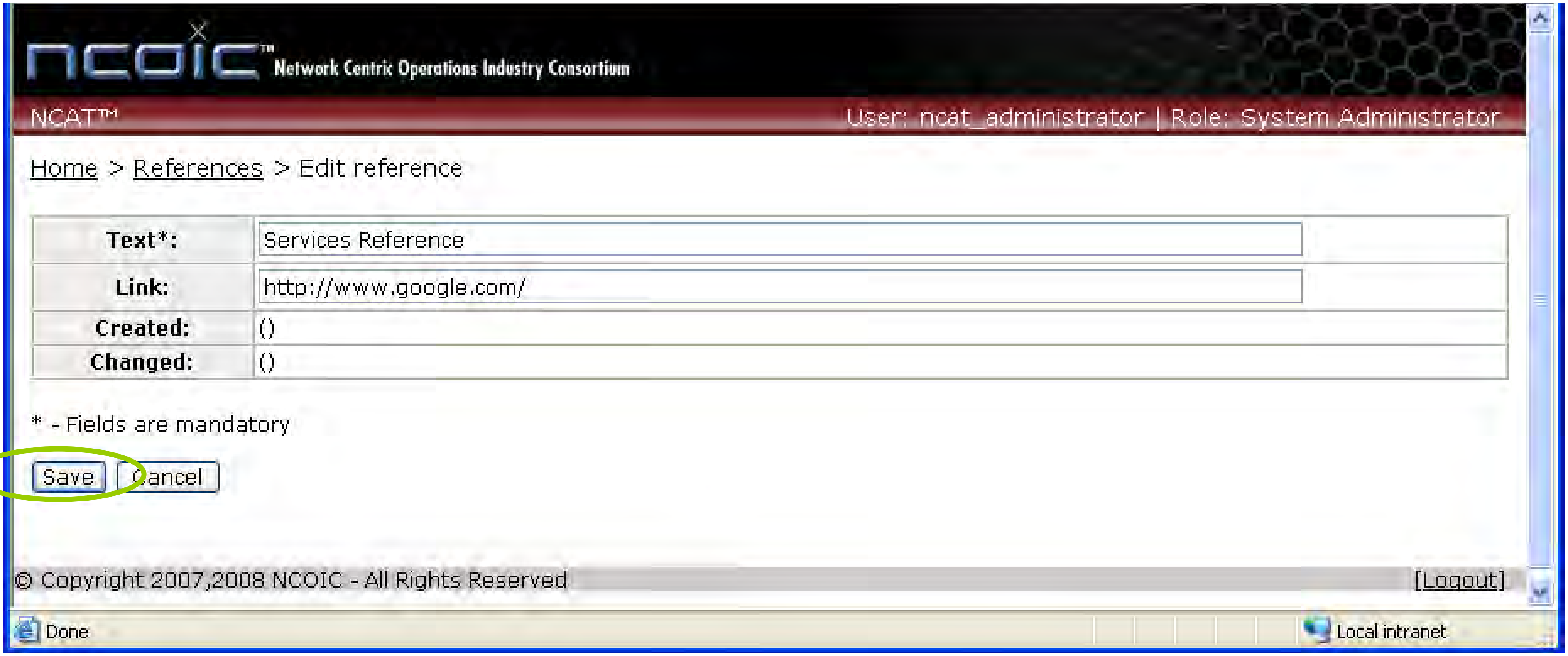
Setup “References”

- Click on “References”. Currently empty.
- If “Services Reference” is not present, click on “New Reference” to create it



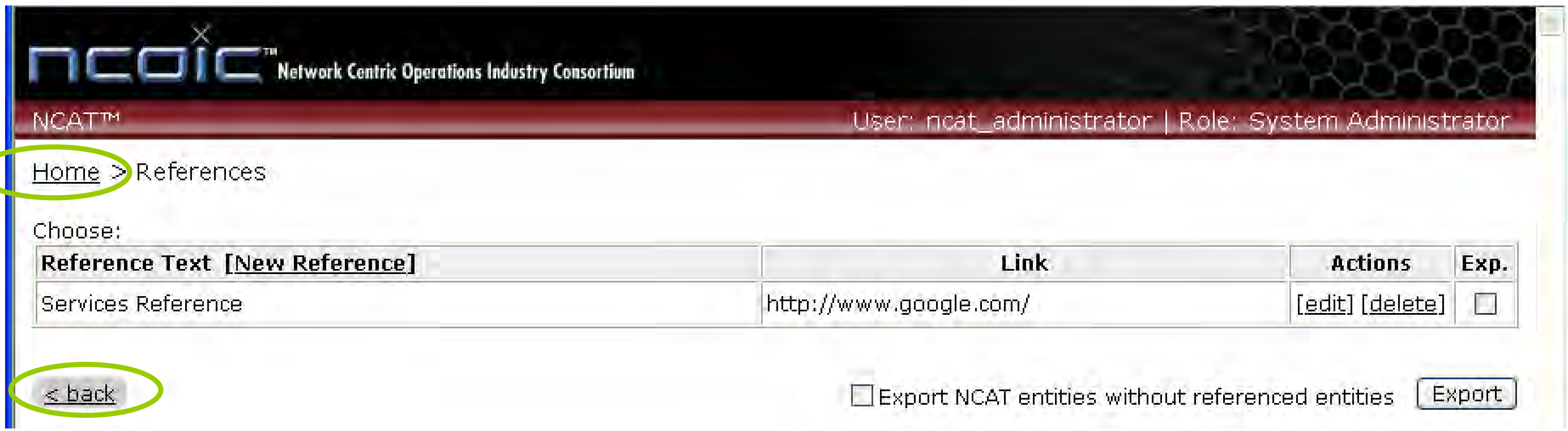
Create new “Services Reference”

- Name new item “Services Reference”
- Add a link to “google” and click “Save”



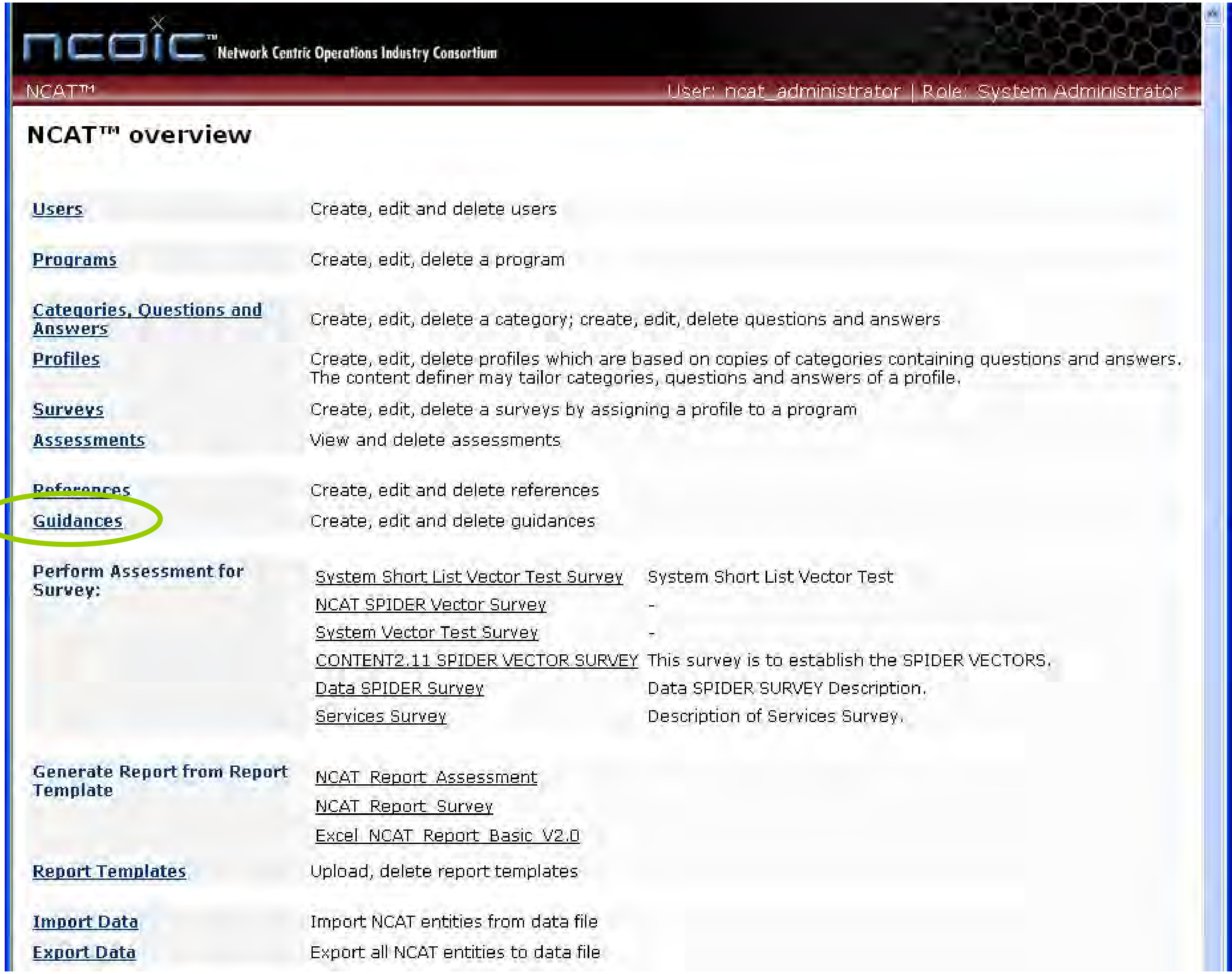
Confirm new “Services Reference”

- Observe new “Services Reference” is created with the link to Google
- Click “back” or “Home” to return “Home”



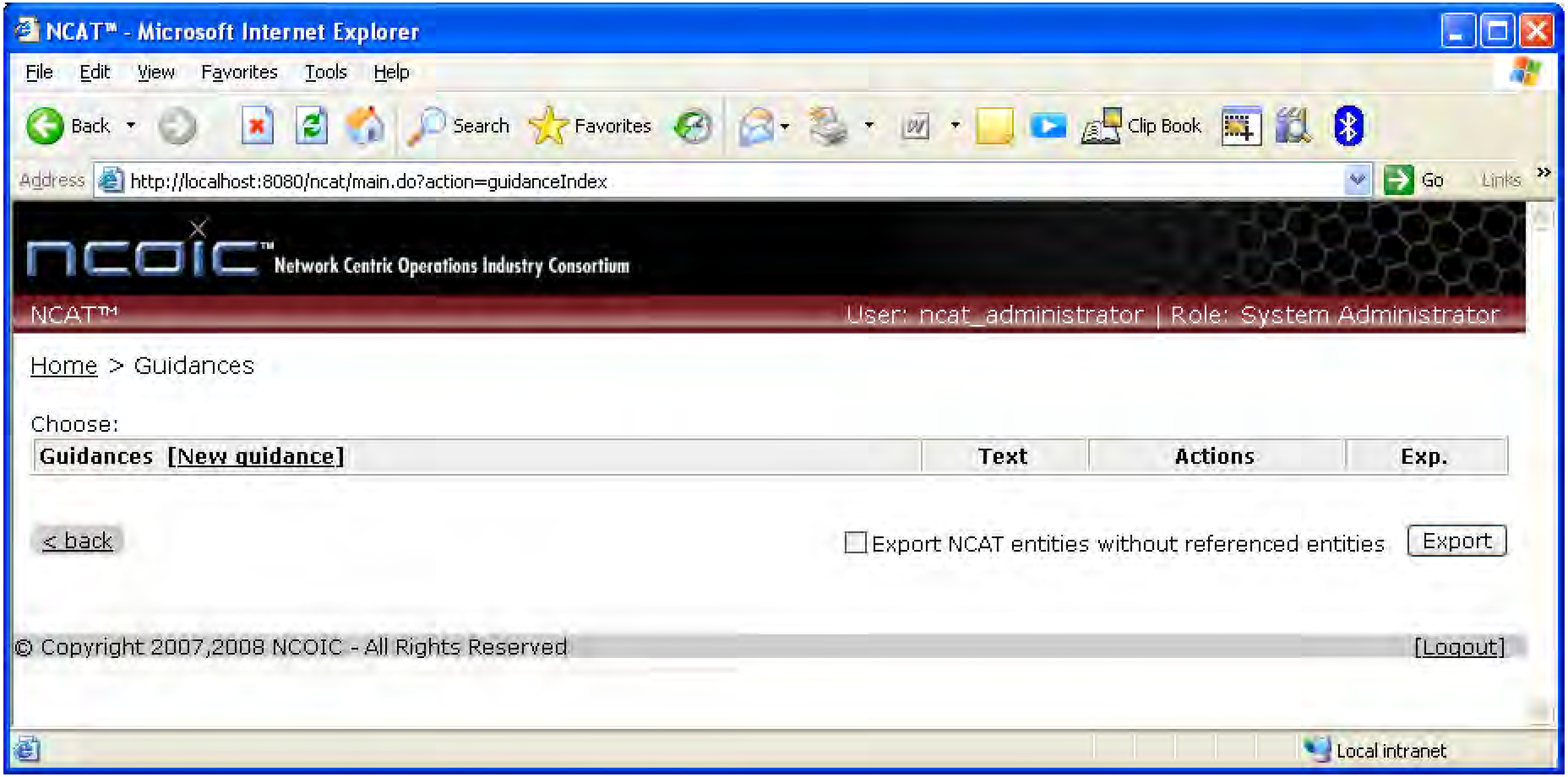
See if any "Guidances" are defined

- Click on "Guidances"
- Observe if any "Guidances" are visible



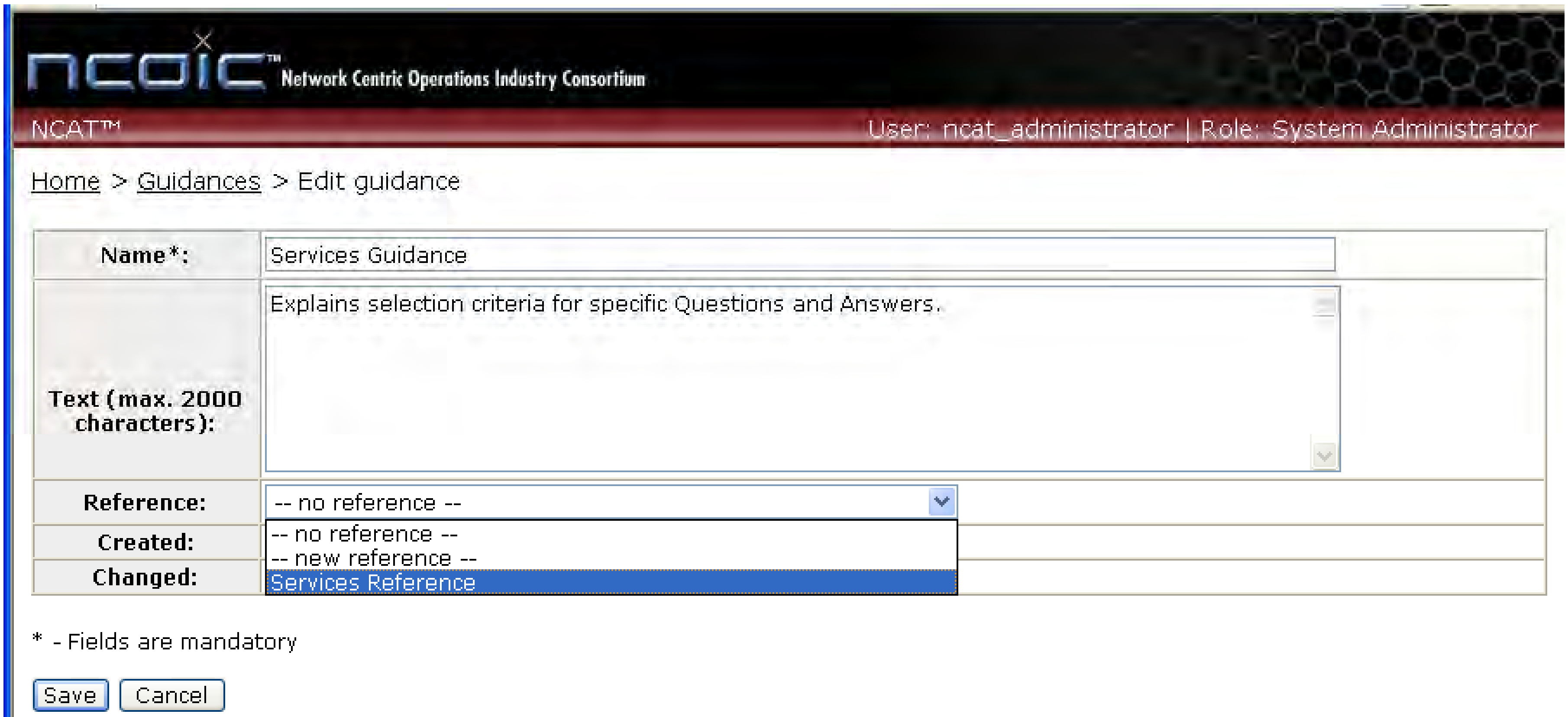
Setup new “Guidance”

- If “Services Guidance” is not present, click on “[New Guidance] to create it.



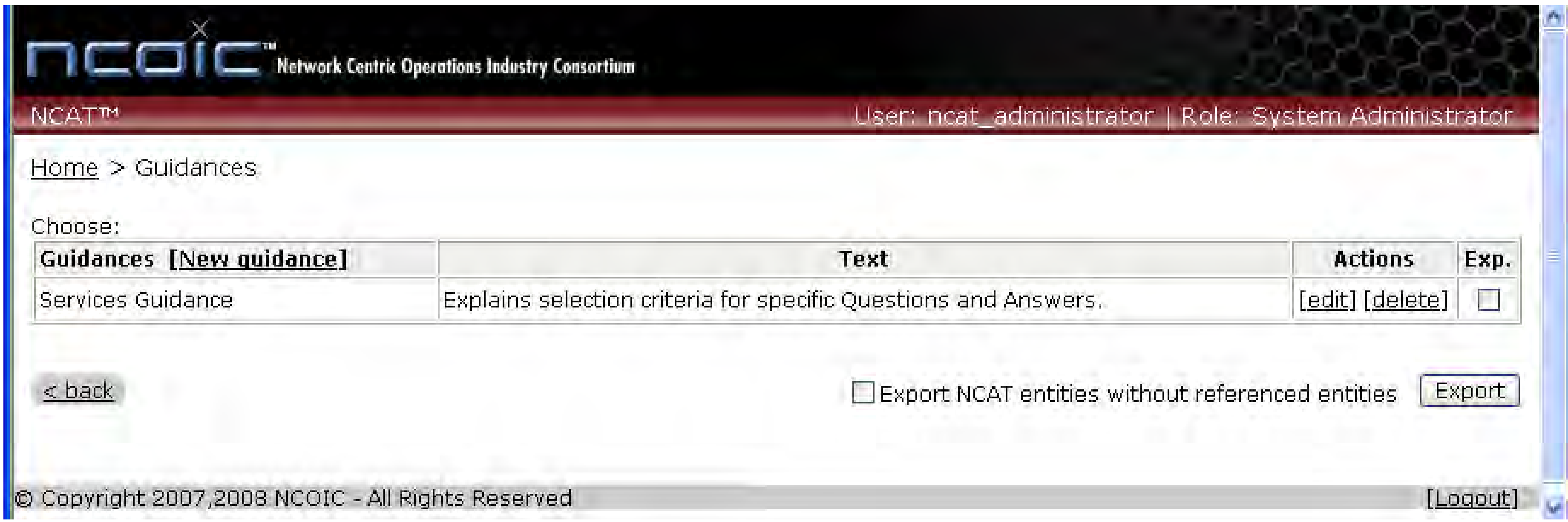
Setup “Guidances”

- Create “Services Guidance”, add Text
- Use the “Reference” pull down to select available “Services Reference”
- Click “Save” to return to “Guidances”. Confirm “Services Guidance”.



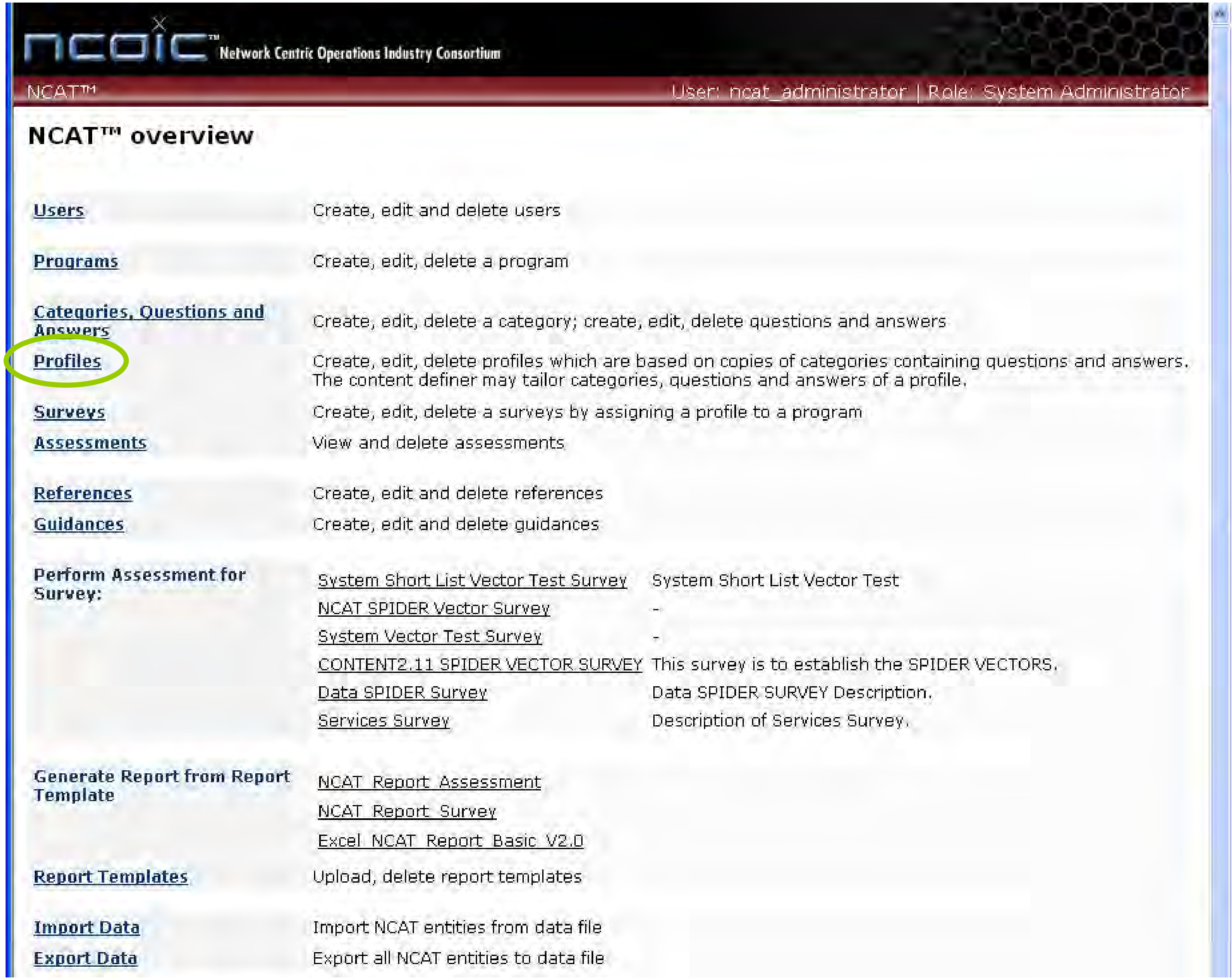
Confirm “Services Guidance”

- Confirm new Guidance successfully created.
- Click “back” or “Home” to return to “Home” screen.



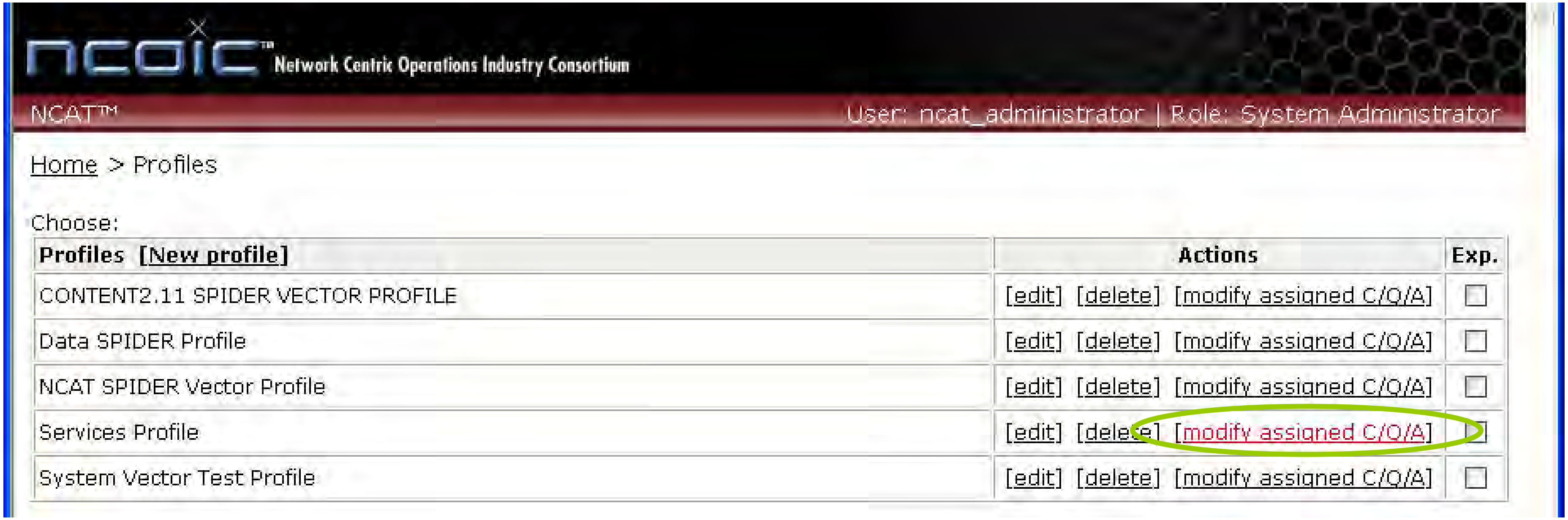
Back to “Home”, Go to “Profiles”

- Click on “Profiles”



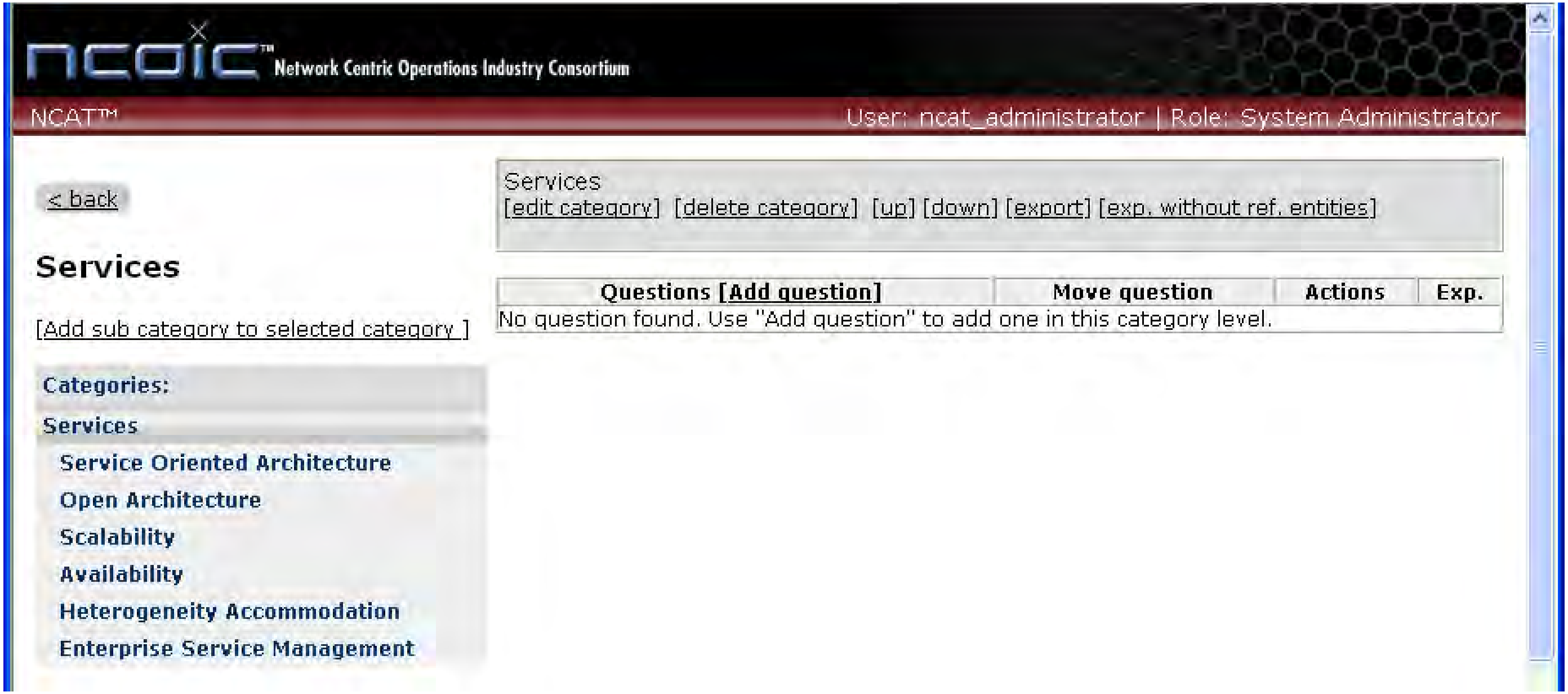
Go back to “Services Profile” to link References

- Click on “Services Profile” Actions “modify assigned C/Q/A”



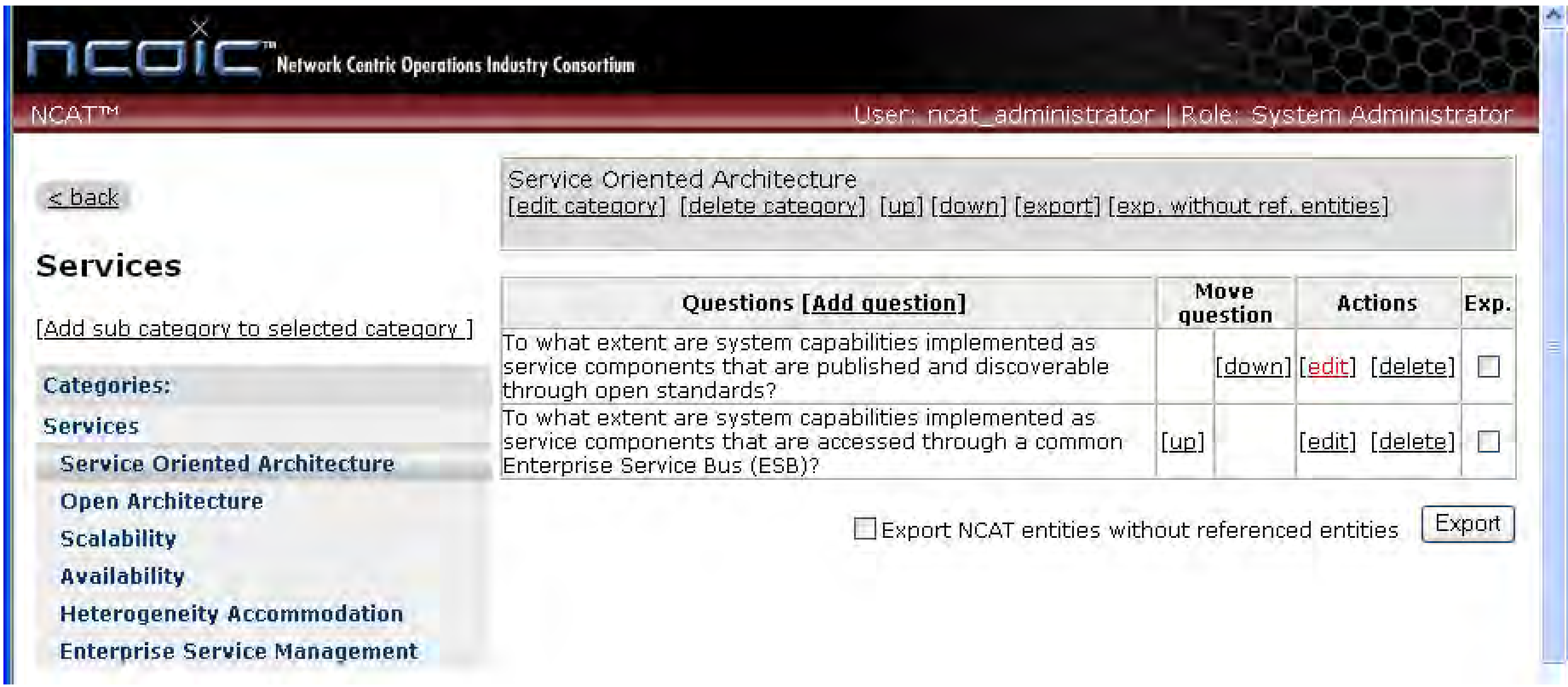
Go to 1st Category and 1st question

- Click on 1st category “Service Oriented Architecture”



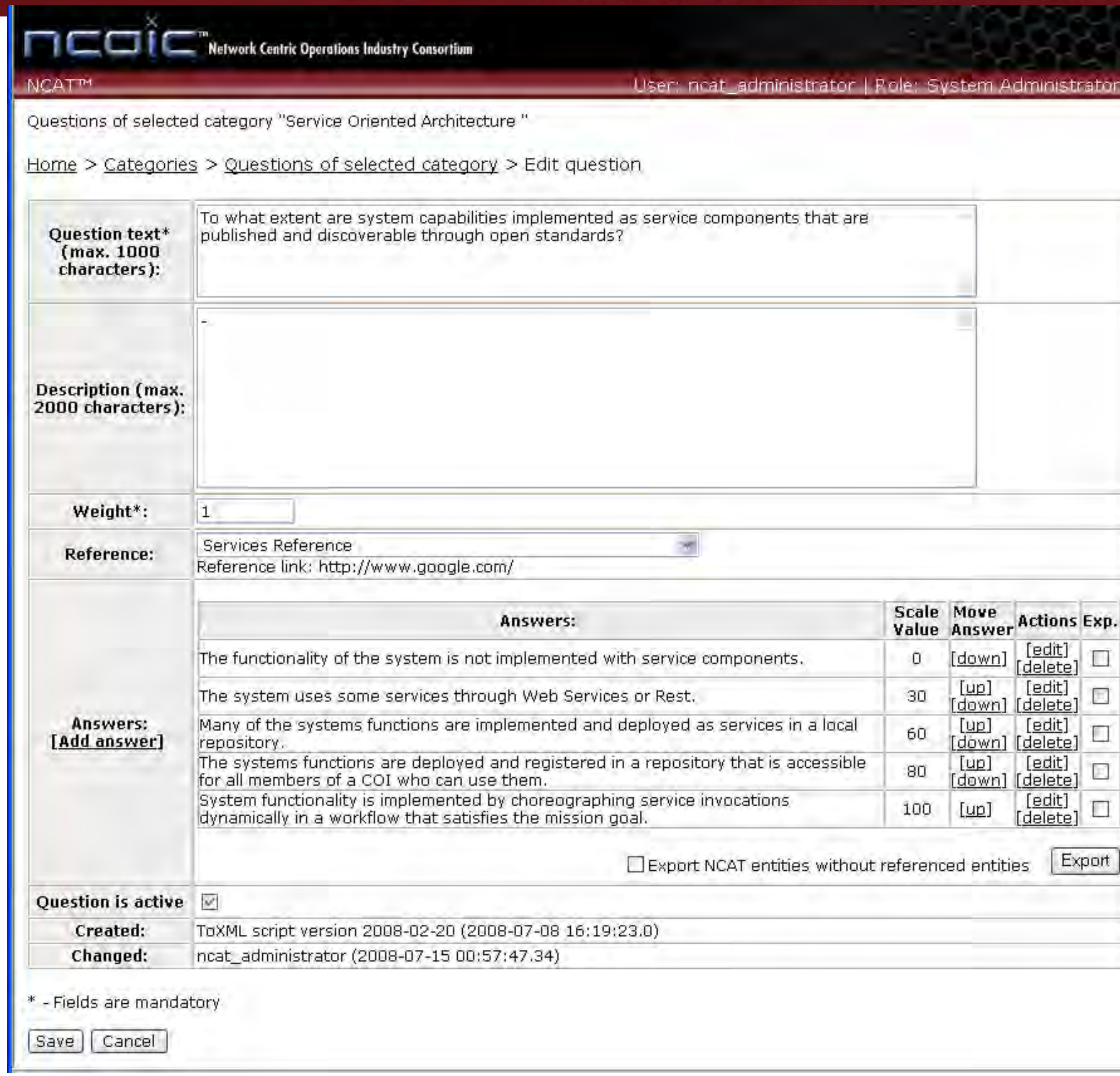
Navigate to Question needing reference

- Both questions in “Service Oriented Architecture” are visible
- Click on Actions “Edit” for top Question



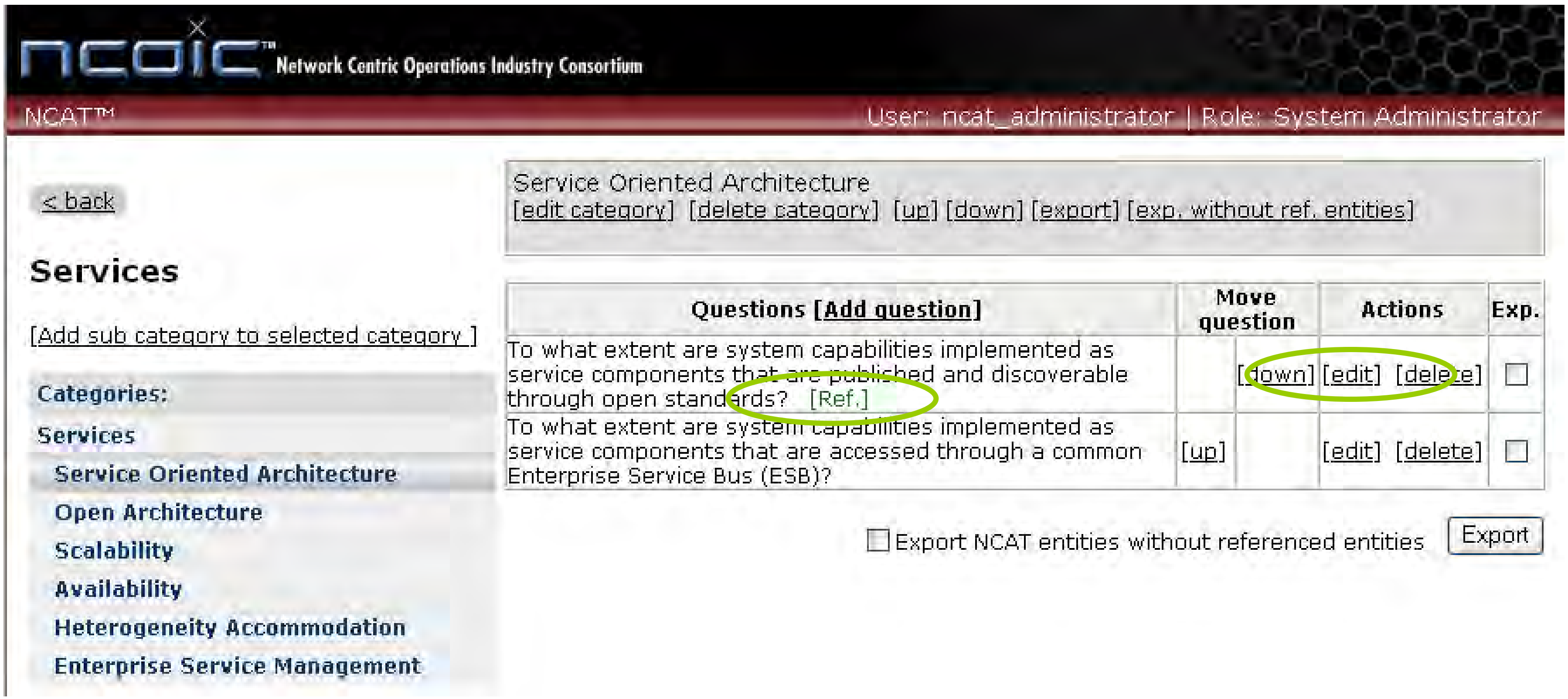
Question Expanded to show attributes

- Observe question structure
  - Text
  - Description
    - Must fill with something
  - Weight
  - Reference
    - Pull down to select “Services Reference”
  - Answers
  - Active box
  - Click “Save”



Confirm Results of adding Reference

- Taken back to Higher Level
- Observe new Green Ref tag
- Click on Edit again



Add Guidance to Answers

- Guidance is not visible until an answer is selected using “edit”
- Guidance aids Assessor in selecting a particular response

Questions of selected category "Service Oriented Architecture "

Home > Categories > Questions of selected category > Edit question

Question text* (max. 1000 characters):	To what extent are system capabilities implemented as service components that are published and discoverable through open standards?
Description (max. 2000 characters):	-
Weight*:	1
Reference:	Services Reference Reference link: http://www.google.com/
Answers: **[Add answer]**	(see answers table below) Export NCAT entities without referenced entities [Export]
Question is active	☑
Created:	ToXML script version 2008-02-20 (2008-07-08 16:19:23.0)
Changed:	ncat_administrator (2008-07-15 00:59:23.355)

Answers:	Scale Value	Move Answer	Actions	Exp.
The functionality of the system is not implemented with service components.	0	[down]	[edit] [delete]	☐
The system uses some services through Web Services or Rest.	30	[up] [down]	[edit] [delete]	☐
Many of the systems functions are implemented and deployed as services in a local repository.	60	[up] [down]	[edit] [delete]	☐
The systems functions are deployed and registered in a repository that is accessible for all members of a COI who can use them.	80	[up] [down]	[edit] [delete]	☐
System functionality is implemented by choreographing service invocations dynamically in a workflow that satisfies the mission goal.	100	[up]	[edit] [delete]	☐

* - Fields are mandatory

Save Cancel

Filling in Answer Guidance & Reference

- Observe Answers can have both Guidance and Reference
- Use pull downs for each to select and resave

Home > Categories > Questions of selected category > "To what extent are system capabilities implemented as service components that are published and discoverable through open standards? " > Edit answer

Answer text* (max. 1000 characters):	Many of the systems functions are implemented and deployed as services in a local repository.
Explanation* (max. 2000 characters):	-
Scale value*:	60
Guidance:	-- no guidance --
Reference:	-- no reference --
Answer is active	☑
Created:	ToXML script version 2008-02-20 (2008-07-08 16:19:23.0)
Changed:	()

* - Fields are mandatory

Save Cancel

Filling in Answer Guidance & Reference

- Observe Answers can have both Guidance and Reference
- Use pull downs for each to select and resave

Home > Categories > Questions of selected category > "To what extent are system capabilities implemented as service components that are published and discoverable through open standards? " > Edit answer

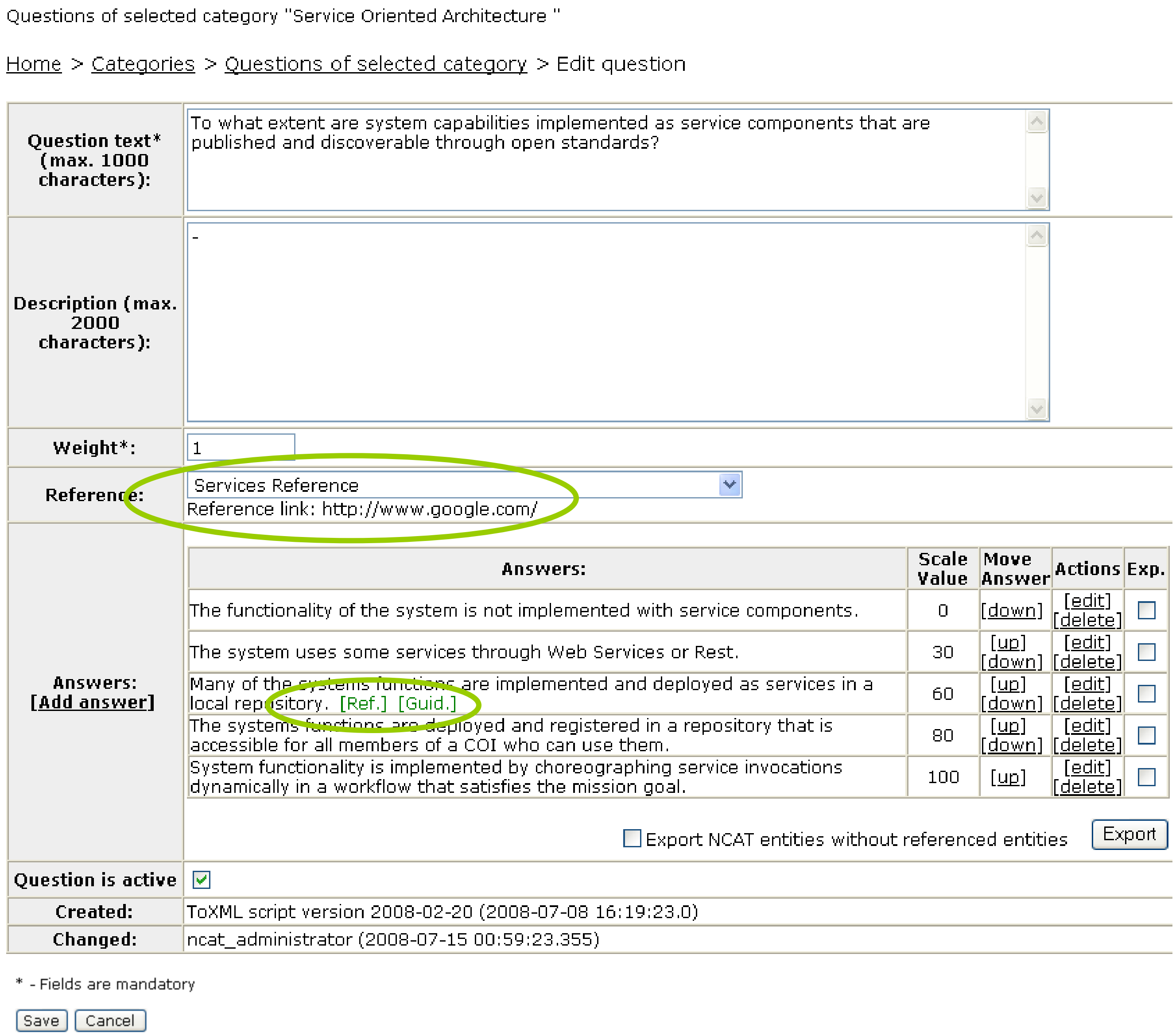
Answer text* (max. 1000 characters):	Many of the systems functions are implemented and deployed as services in a local repository.
Explanation* (max. 2000 characters):	-
Scale value*:	60
Guidance:	Services Guidance Guidance text: Explains selection criteria for specific Questions and
Reference:	Services Reference Reference link: http://www.google.com/
Answer is active	☑
Created:	ToXML script version 2008-02-20 (2008-07-08 16:19:23.0)
Changed:	ncat_administrator (2008-07-15 01:09:22.215)

* - Fields are mandatory

Save Cancel

Confirm Results

- Observe References for the Question and the [Ref] and [Guid] for an answer.
- Click “Save” and return to “Profile” list.
- Click “Home” to start “Assessment”



Log out as Admin, Log in as "Services"

- Click on Logout to logout as the ncat_ administrator
- Prepare to log back in as the Assessor "John Q Services" with a username "Services" and password "ncat"

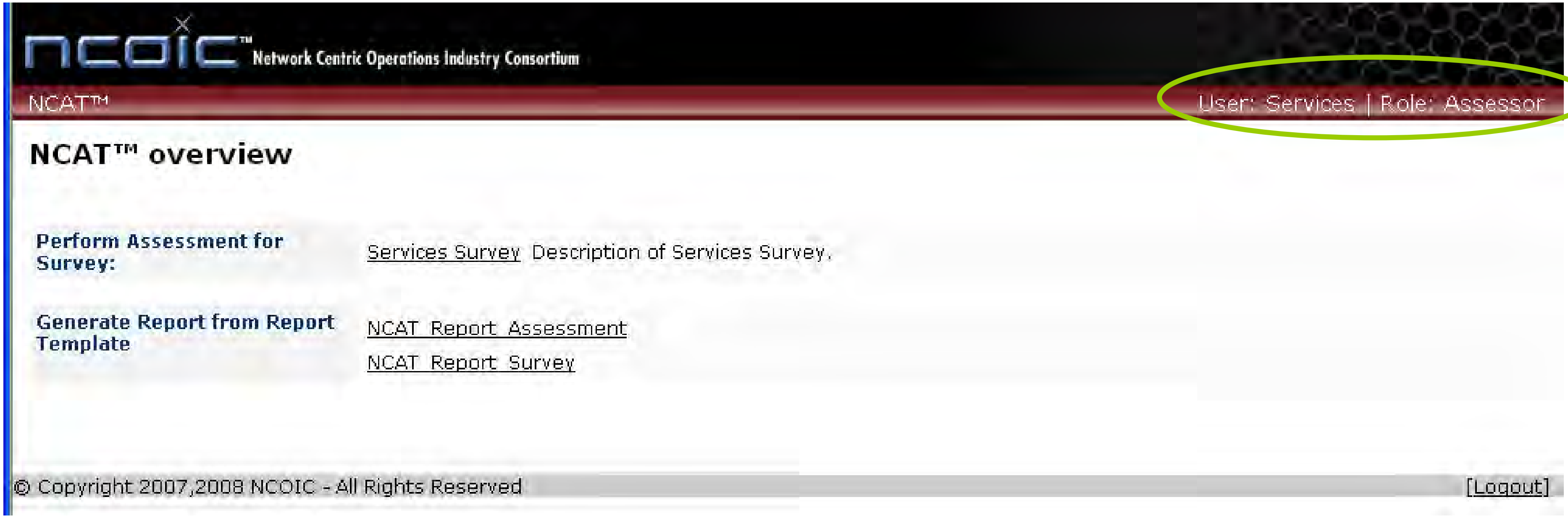
NCAT Tutorial Recap

- The user will download the Java Zip files and install the NCAT program
- The user will log in as the "ncat_administrator" & do the following:
  - setup a new User Account for "John Q Services" (username "Services",
  - create a new Program called "Services Program",
  - create a new Profile called "Services Profile",
  - create a new Survey called "Services Survey",
  - set Planned Values, log out

- The user will:
  - log in a second time as "Services",
  - perform the assessment answering 25 questions
  - Run some reports and examine them

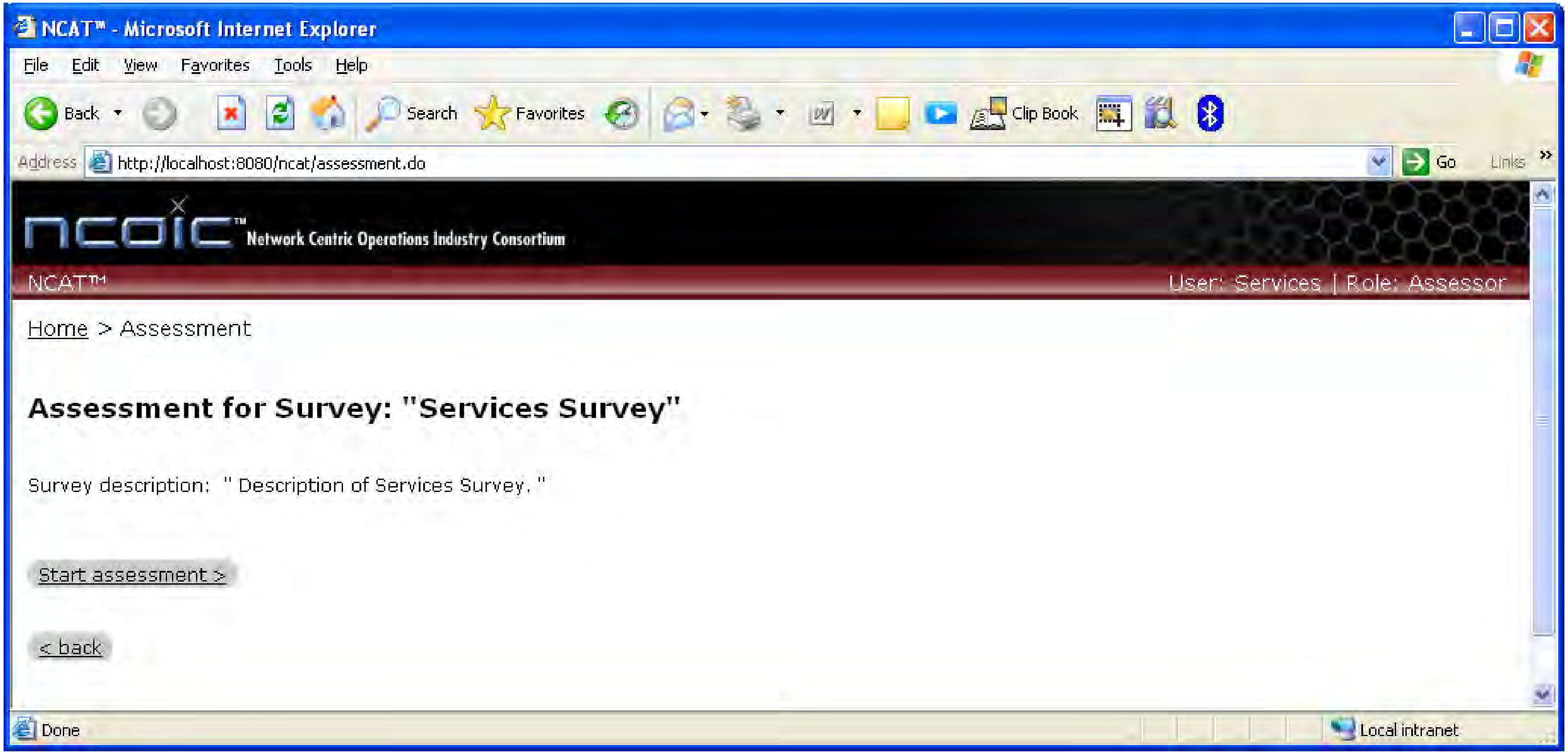
Log out as Admin, Log in as “Services”

- Login as “Services” (password = ncat)
- Perform Assessment for “Services Survey”
- Confirm User: “Services” in a Role of “Assessor”
- Note significantly cleaner “Home” screen showing only what this user is setup to accomplish
- Click on “Perform Assessment” for “Services Survey”

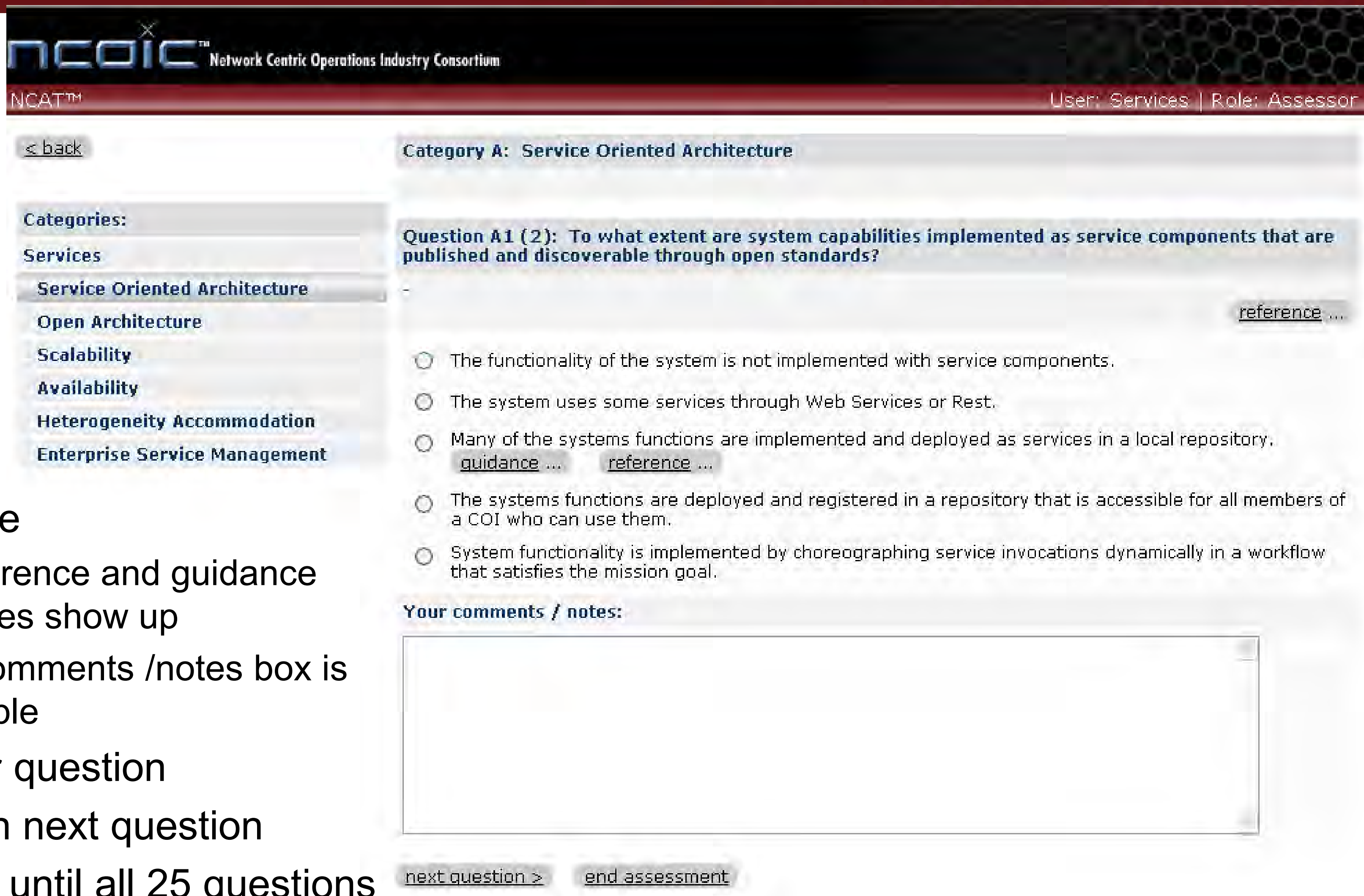


Start Assessment

- Click on “Start Assessment”



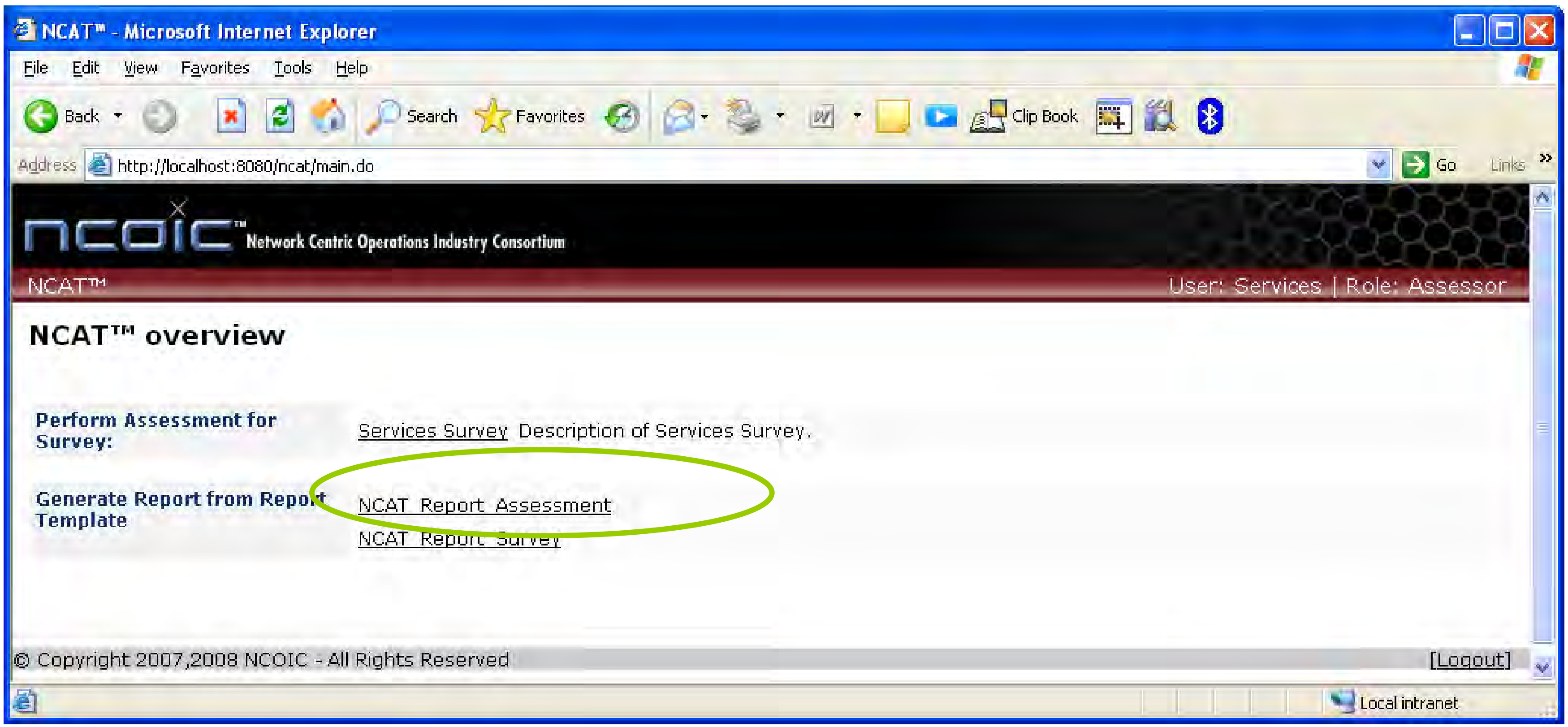
Observe 1st question



- Observe
  - reference and guidance boxes show up
  - a comments /notes box is visible
- Answer question
- Click on next question
- Repeat until all 25 questions are answered

Assessment Ends & returns to "Home"

- End of Assessment returns Assessor to NCAT Overview
- End of Assessment by User: "Services"
- It is possible to have multiple Assessors (not covered in this tutorial)
- Click on "NCAT Report Assessment"

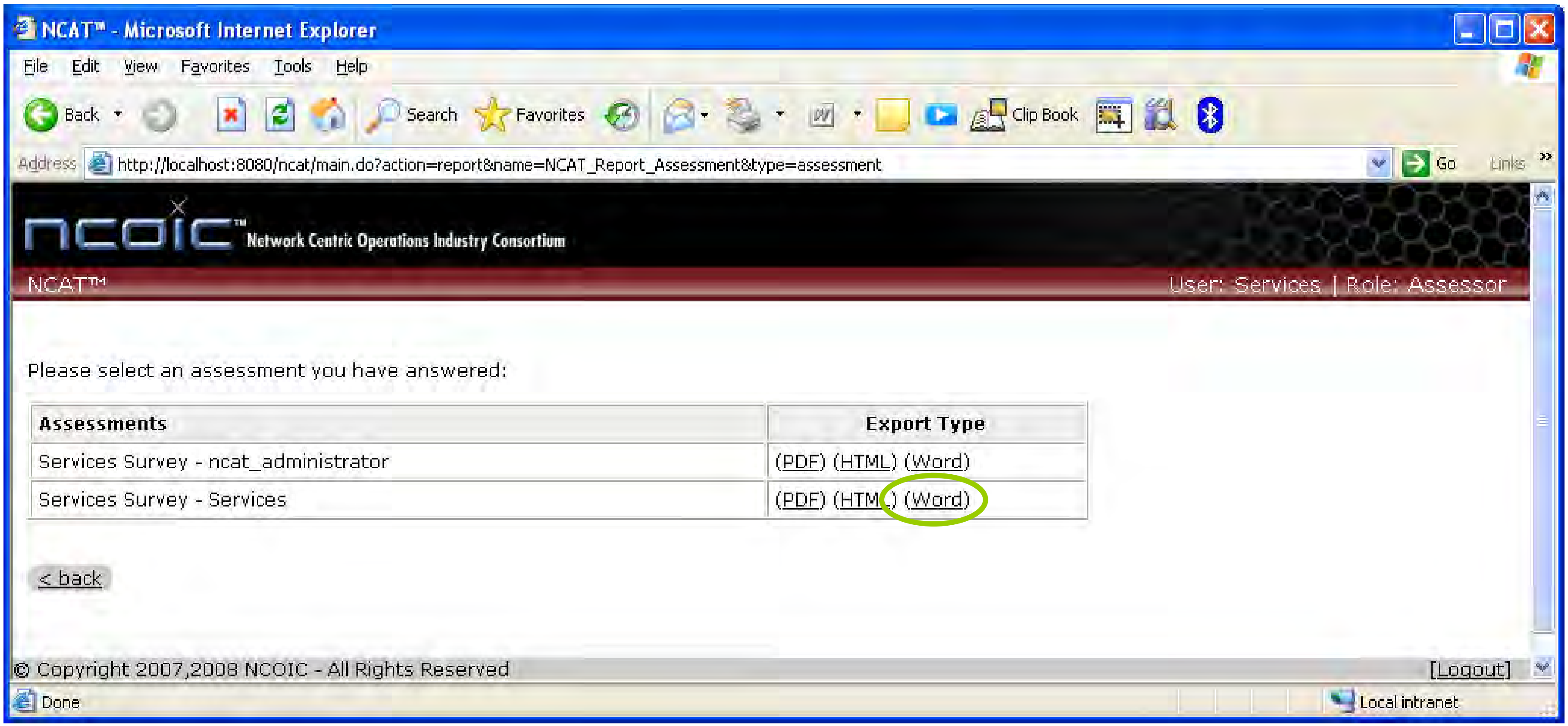


Java Tutorial Recap

- The user will download the Java Zip files and install the NCAT program
- The user will log in as the "ncat_administrator" & do the following:
  - setup a new User Account for "John Q Services" (username "Services",
  - create a new Program called "Services Program",
  - create a new Profile called "Services Profile",
  - create a new Survey called "Services Survey",
  - set Planned Values, log out
- The user will:
  - log in a second time as "Services",
  - perform the assessment answering 25 questions
  - Run some reports and examine them

Choose Report Type

- Choose “Services Survey” Assessment performed by username “Services”
- Observe there are three Export Types: PDF, HTML, Word
- Choose Export Type, for this exercise click on “(Word)”



Services Survey Assessment Report

ncoic™ Network Centric Operations Industry Consortium

Assessment

Assessment Report showing all Information for the specified Assessment

Assessment Information	
Note: The information below is specific to the program beeing assessed.	
Program Information	
Program Name:	Services Program
Program Purpose:	-
Lead Organization: (e.g. Army, Dia, Industry)	NCAT Functional Team
Program Manager's Information	
Name:	
Email Adress:	
Telephone Number:	
Office Code/Symbol:	
NCAT Assessment Information	
Completition Date: (MM/DD/YYY)	07/15/2008
Lead Assessor's Information	
Name:	Services
Email Adress:	John_Q_Services@Raytheon.com
Telephone Number:	(972) 123-4567
Role in Program:	Assessor
General Role:	

Note: not filled in since "Program Configuration Manager" role was not Established.

Finding and Using the Legend

Legend	
B Root Category	First Category Element
B_1 Sub Category	Subordinated Category Element
Question	Question element
Answer	Answer from survey
Selected Answer	Answer selected by Assessor
Planned Answer	Expected Answer
Planned and Selected Answer	Selected Answer corresponds to expected Answer

- The Legend is on the very last page of the report.
- Legend explains the color code for reading the assessment results
  - Black means “not selected”
  - Red means “Planned or Expected Value” set by ncat_administrator
  - Blue means “achieved value” selected by the user “Services”
  - Green means the “achieved value” set by the Assessor matches the “Planned or Expected Value” set by the ncat_administrator

A Service Oriented Architecture

A1

To what extent are system capabilities implemented as service components that are published and discoverable through open standards?

The functionality of the system is not implemented with service components.

The system uses some services through Web Services or Rest.

Planned

Many of the systems functions are implemented and deployed as services in a local repository.

The systems functions are deployed and registered in a repository tha[t] ... members of a COI who can use them.

Achieved

System functionality is implemented by choreographing service invocations dynamically in a workflow that satisfies the mission goal.

comment

Use Comments box to log objective evidence or rationale for answer.

Comment

A2

To what extent are system capabilities implemented as service components that are accessed through a common Enterprise Service Bus (ESB)?

No Enterprise Service Bus is used by the system.

Proprietary middleware provides some of the basic services of an ESB. No specific procedures are in place to ensure uniform compliance.

An ESB is implemented internally that can provide basic services to the platform. Some standards are utilized in the implementation.

An ESB is implemented using widely used open standards that provide all the net-centric core services as well as critical event processing, security services and autonomic capabilities. Most of the system's functionality is implemented as services.

An open standard based COTS ESB that can mediate dynamic requests and match QoS requests with appropriate SLAs in non-real time, near real time and real time and interact with other ESBs deployed on the net-centric environment. The ESB is verified and certified to provide these capabilities. Uniform adoption is assured by comprehensive governance processes.

comment

B Open Architecture

B1

Is the system architecture based on loosely-coupled interactions, enabling the internal components to map to well-defined external interfaces?

The system is tightly integrated and not modular.

The system is constructed of well defined modules with well defined interfaces, but the interfaces are proprietary or specific to the program.

The system is constructed of well defined modules with well defined interfaces. Interfaces are based on widely used open standards and consistent with the program or platform.

The system is constructed of well defined modules with well defined interfaces. Interfaces are based on widely used open standards and consistent with the COI.

The system is constructed using invoked dynamically discovered services or through choreography of services (or both). Services implemented by this system are deployed and dynamically discoverable on the net-centric environment and accessed using net-centric core services for discovery, mediation, messaging, and connectivity.

comment

B2

Is Web access implemented by the program built using Web Foundational standards: Hypertext Transfer Protocol (HTTP), Hypertext Mark up Language (HTML), File Transfer Protocol (FTP), User Datagram Protocol (UDP), Transport Control Protocol (TCP), Internet Protocol (IP), Simple Mail Transfer Protocol (SMTP), Multi-purpose Internet Mail Extensions (MIME), Uniform Resource Locator (URL), and Unicode universal character set?

Web Access is not implemented by this system.

Planned

This system utilizes some, but not all of the listed standards.

This system implements and uses Web Access using most or all of t[he] ... their current form. The standards used have been verified to work tog[ether] ...

Achieved

comment

B3

Are Web services and web access implemented by the program built using Web Emerging Standards or Best Practices: HTTP State Management Mechanism, MIME Encapsulation of Aggregate Documents such as HTML (MHTML), Web Distributed Authoring and Versioning (Web-DAV)?

Web Access is not implemented in this system.

This system utilizes distributed components but not web services.

This system utilizes some, but not all of the listed standards.

This system implements and uses Web Services using most or all of the listed standards.

This system utilizes Web Services standards and also utilizes Grid computing standards.

comment

B4

Are Web services and web access implemented by the program built using XML Foundational Standards: XML Namespaces, Extensible Style Language Transformations (XSLT), Extensible Style Language (XSL), XML Path Language (XPath), Cascading Style Sheets (CSS)?

Neither Web Access nor Services is implemented in this system.

This system utilizes distributed components but not web services.

This system utilizes some, but not all of the listed standards.

This system implements and uses Web Services using most or all of the listed standards.

This system utilizes Web Services standards and also utilizes Grid computing standards.

comment

...re Transfer ... Language

Legend

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This system utilizes some, but not all of the listed standards.

This system implements and uses Web Services using most or all of the listed standards.

This system utilizes Web Services standards and also utilizes Grid computing standards.

comment

B6 *Are Web services products compliant with WS-Security Profile?*

Web Services are not implemented in this system.

Web services that are used are implemented with proprietary interfaces.

Web services use products that are compliant, but configurations are not verified.

Yes, fully compliant and verified.

comment

B7 *Are Web services products compliant with the Web Services Interoperability (WS-I) Basic Profile?*

Web Services are not implemented in this system.

Web services that are used are implemented with proprietary interfaces.

Web services use products that are compliant, but configurations are not verified.

Yes, fully compliant and verified.

comment

C Scalability

C1 *How many consumers of services deployed by this system are expected?*

Web Services are not implemented in this system.

Unknown/estimated.

Empirical evidence shows that the system can support the expected number of consumers.

The system has been formally tested to meet the service level as defined in the specifications and is capable of scaling to meet excess demand.

The system includes automatic detection of increased usage and will automatically increase capacity without human intervention.

comment

C2 *How many service invocations of services deployed by this system per hour (or per some appropriate unit of time) are expected?*

Web Services are not implemented in this system.

Unknown/estimated.

Empirical evidence shows that the system can support the expected number of service invocations.

The system has been formally tested to meet the service level as defined in the specifications and is capable of scaling to meet excess demand.

The system includes automatic detection of increased service load and will automatically increase capacity without human intervention.

comment

C3 *On what assumptions or empirical tests are the above mentioned estimates based?*

Web Services are not implemented in this system.

Unknown/estimated.

Past usage history.

Surveys and agreements have been executed to provide best estimates.

Hardware and software facilities are in place to scale automatically to meet usage and load requirements.

comment

C4 *What performance analysis has been done to understand or predict the ability of the service to handle number of end-user consumers?*

Web Services are not implemented in this system.

Unknown/estimated.

Empirical evidence shows that the system can support the expected number of consumers.

The system has been formally tested to meet the service level as defined in the specifications and is capable of scaling to meet excess demand.

Hardware and software facilities are in place to scale automatically to meet usage and load requirements.

comment

C5 *What performance analysis has been done to understand or predict the ability of the service to handle the expected number of calling services?*

Web Services are not implemented in this system.

Unknown/estimated.

Empirical evidence shows that the system can support the expected number of service demands.

The system has been formally tested to meet the service level as defined in the specifications and is capable of scaling to meet excess demand.

Hardware and software facilities are in place to scale automatically to meet usage and load requirements.

comment

D Availability

D1 *Does the program have a continuity of operations plan?*

No plan is in place.

Basic plan allows for MTBF and MTB recovery. No testing plan is in place.

Basic plan allows for MTBF and MTB recovery. Testing plan is in place and exercised regularly.

A continuity plan is in place to assure minimal MTBR including regular backups and testing.

A fault tolerant continuity of operations plan is in place and it is exercised on a regular basis with contingency operations also verified.

comment

D2 *What is the plan for providing service during routine maintenance (hardware and software)?*

No plan is in place.

Scheduled outages.

Scheduled outages. Regular backups and test of backups is done.

Backup systems are used to carry load while prime system is maintained. Synchronization is manual and requires man in the loop.

Backup systems are used to carry load while prime system is maintained, synchronization is automatic.

Achieved matches Planned

comment

D3 *What is the plan for providing service during catastrophic failures (e.g. massive outages of the power grid, physical destruction of the hosting facility)?*

No plan is in place.

Offsite backup and archives. Secondary site has been identified to reconfigure and restart. MTBR > 1 day.

Offsite backup and archives. Secondary site has been identified to reconfigure and restart. MTBR less than 1 day.

Distributed facilities are able to pick up load with some degradation of performance.

Completely redundant hardened site with automatic failover. No disruption of service. Failover is regularly tested and call

comment

D4 *Does the continuity supporting the techn*

No plan is in place.

Support plans include s

Support plans include s

Legend

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Evacuation plans are in place, but service would be disrupted during an emergency action.

Yes, Emergency support or evacuation procedures are in place and tested on a regular basis.

comment

D5 *What percent of threat scenarios have been identified and validated for application to your design?*

No threat scenarios have been considered in the planning.

Approximately 25 percent of threat scenarios have been considered in the planning.

Approximately 50 percent of threat scenarios have been considered in the planning.

Approximately 75 percent of threat scenarios have been considered in the planning.

A robust set of threat scenarios has been considered in the planning.

comment

E Heterogeneity Accommodation

E1 *How do you describe in which way the system will support bandwidth variability and universal utility on the battlefield independent of bandwidth constraints?*

Only will support High Bandwidth wired LAN connection.

Multiple versions will be available for low to high bandwidth environments.

The service has logic that will sense bandwidth availability but cannot adapt and will, thus only notify user of constraints and potential latency issues.

The service will adapt to bandwidth conditions.

The will service adapt to delivering end-to-end capabilities over a broad range of bandwidths (from low bit-rate tactical communications to multi-gigabit backbone service), environments (fixed and wireless), and end-user devices (e.g., PDAs, laptops, workstations, mainframes).

comment

E2 *Does the system support delivery of capabilities to thin or browser-based clients, especially those that provide adaptability to a variety of disadvantaged edge environments for end-users?*

The program can only support Client server environments.

The program requires high bandwidth to support thin or browser-based clients via servlets or portlets.

The program may support low bandwidth to thin or browser-based clients via servlets or portlets.

The program does support low bandwidth to thin or browser-based clients via servlets or portlets.

The prog those that provide

Achieved matches Planned

comment

D1	*Does the program have a continuity of operations plan?*
	No plan is in place.
	Basic plan allows for MTBF and MTB recovery. No testing plan is in place.
	Basic plan allows for MTBF and MTB recovery. Testing plan is in place and exercised regularly.
	A continuity plan is in place to assure minimal MTBR including regular backups and testing.
	A fault tolerant continuity of operations plan is in place and it is exercised on a regular basis with contingency operations also verified.
comment	
D2	*What is the plan for providing service during routine maintenance (hardware and software)?*
	No plan is in place.
	Scheduled outages.
	Scheduled outages. Regular backups and test of backups is done.
	Backup systems are used to carry load while prime system is maintained. Synchronization is manual and requires man in the loop.
	Backup sys... tion is automatic.
comment	
D3	*What is the plan for providing service during catastrophic failures (e.g. massive outages of the power grid, physical destruction of the hosting facility)?*
	No plan is in place.
	Offsite backup and archives. Secondary site has been identified to reconfigure and restart. MTBR > 1 day.
	Offsite backup and archives. Secondary site has been identified to reconfigure and restart. MTBR less than 1 day.
	Distributed facilities are able to pick up load with some degradation of performance.
	Completely redundant hardened site with automatic failover. No disruption of service. Failover is regularly tested and calibrated.
comment	
D4	*Does the continuity ... supporting the techni...*
	No plan is in place.
	Support plans include s...
	Support plans include s...

Achieved matches Planned

Legend

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	Evacuation plans are in place, but service would be disrupted during an emergency action.
	Yes, Emergency support or evacuation procedures are in place and tested on a regular basis.
comment	
D5	*What percent of threat scenarios have been identified and validated for application to your design?*
	No threat scenarios have been considered in the planning.
	Approximately 25 percent of threat scenarios have been considered in the planning.
	Approximately 50 percent of threat scenarios have been considered in the planning.
	Approximately 75 percent of threat scenarios have been considered in the planning.
	A robust set of threat scenarios has been considered in the planning.
comment	
E	Heterogeneity Accommodation
E1	*How do you describe in which way the system will support bandwidth variability and universal utility on the battlefield independent of bandwidth constraints?*
	Only will support High Bandwidth wired LAN connection.
	Multiple versions will be available for low to high bandwidth environments.
	The service has logic that will sense bandwidth availability but cannot adapt and will, thus only notify user of constraints and potential latency issues.
	The service will adapt to bandwidth conditions.
	The will service adapt to delivering end-to-end capabilities over a broad range of bandwidths (from low bit-rate tactical communications to multi-gigabit backbone service), environments (fixed and wireless), and end-user devices (e.g., PDAs, laptops, workstations, mainframes).
comment	
E2	*Does the system support delivery of capabilities to thin or browser-based clients, especially those that provide adaptability to a variety of disadvantaged edge environments for end-users?*
	The program can only support Client server environments.
	The program requires high bandwidth to support thin or browser-based clients via servlets or portlets.
	The program may support low bandwidth to thin or browser-based clients via servlets or portlets.
	The program does support low bandwidth to thin or browser-based clients via servlets or portlets.
	The prog... those that provide...
comment	

Achieved matches Planned

F	Enterprise Service Management
F1	*Does the service provide instrumentation to enable the service provider to determine the current operational state and performance level of the service?*
	The service does not provide instrumentation to enable the service provider to determine the current operational state and performance level of the service.
	The service does provide instrumentation to partially enable the service provider to determine the current operational state and performance level of the service.
	Scalability, configuration, diagnosing, healing and error logging and recovery require an operator, and operator is assisted by a comprehensive set of instrumentation and tools. Logging of errors is automatic.
	Comprehensive system support and network monitoring provides operator with online configuration and error diagnosing and recovery. Logging is uniform across the domain.
	Automatic and dynamic scalability, self-configuration, self-healing, self-diagnosing, and uniform error logging and recovery are enabled across the net-centric environment.
comment	
F2	*How do you describe the nature of the service management information made available to consumers and providers of the net-centric environment such the Global Information*
	No service management information function will be made available to consumers or provider of the service.
	Service level agreements are included in the description of the service, but are not available for runtime use.
	Limited service management information, not including performance metrics and problem/outage status information, will be made available to consumers or providers of the service.
	Service management information, including performance metrics and problem/outage status information, will be made available to consumers and providers of the service.
	SLAs are part of the service descriptor and are based on open standards. The QoS is dynamically available and can be used to match requestors' required SLAs with a provider's QoS. These services are dynamically discoverable and accessed using net-centric core services for discovery, mediation, messaging, and connectivity.
comment	
F3	*To what extent are protocols and standards being used to collect and disseminate service management information?*
	No service Management function is provided.
	Limited QoS information is available at runtime. It is available only through proprietary interfaces and APIs. SLA is described with program specific formats.
	SLAs are defined with open standard formats and are dynamically discoverable. Mechanisms are available to provide run time QoS of deployed services using open standards.
	If service Management function is provided, standards used to collect and disseminate service management information, and in what format will it be made available (e.g., SNMP, XML, CIM).
	SLAs are part of the service descriptor and are based on open standards. The QoS is dynamically available and can be used to match requestors' required SLAs with a provider's QoS. These services are dynamically discoverable and accessed using net-centric core services for discovery, mediation, messaging, and connectivity.
comment	

F4	*Has this program provided completed examples of all Service Level Agreements negotiated by this provider with others?*
	No Service Level Agreements (SLA) has been or will be negotiated by this service provider with others.
	Some SLAs have been negotiated and provided for other service providers.
	SLAs have been negotiated and provided with other service providers with which it will interoperate.
	A complete list of completed examples of all Service Level Agreements (SLA) negotiated by this service provider with all other service providers and consumers with which it will interoperate has been provided.
	SLAs have been negotiated with all other providers and consumers and are automatically enforced by the infrastructure - the ESB.
comment	

Legend	
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Score Summary

- 25 Total Questions
- Max possible score = 25 x 100 point per question = 2500
- Planned 38.4%
- Achieved 76%
- Observe –
  - Does not have to approach max, just meet or exceed planned

Score Summary

Section	Section	Total Questions Applicable	Total Questions Not Applicable	Max Score		Score	Normalized
A	Service Oriented Architecture	2	0	200	Planned	70	35.00 %
					Achieved	160	80.00 %
B	Open Architecture	7	0	700	Planned	280	40.00 %
					Achieved	660	94.29 %
C	Scalability	5	0	500	Planned	160	32.00 %
					Achieved	300	60.00 %
D	Availability	5	0	500	Planned	180	36.00 %
					Achieved	325	65.00 %
E	Heterogeneity Accommodation	2	0	200	Planned	100	50.00 %
					Achieved	130	65.00 %
F	Enterprise Service Management	4	0	400	Planned	170	42.50 %
					Achieved	325	81.25 %
	Combined Rating	25	0	2500	Planned	960	38.40 %
					Achieved	1900	76.00 %

NCOIC™'s
Systems of systems, Capabilities, Operations, Programs, and Enterprises (SCOPE™) Model Tutorial

Hans Polzer
Lockheed Martin
Chair, SCOPE Working Group, NCOIC

25 October 2010

Approved for Public Release
Distribution Unlimited
NCOIC-NDIA- HP20101025

ncoic™

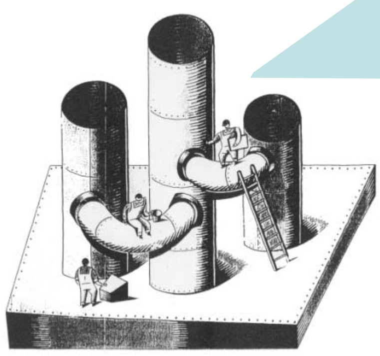
Network Centric Operations Industry Consortium

Vision

Industry working together with our customers to provide a network centric environment where all classes of information systems interoperate by integrating existing and emerging open standards into a common evolving global framework that employs a common set of principles and processes.

Net-Enabled Future

Today: Stovepiped Systems, Point-to-Point Networks



Mission

Our mission is to facilitate the global realization of Network Centric Operations. We seek to enable interoperability across the spectrum of joint, interagency, intergovernmental, and multinational industrial and commercial operations. NCOIC is global, with membership open to those who wish to apply the vast potential of network centric technology to the operational challenges faced by our nations and their citizens.

NCOIC is a Unique Organization

NCOIC™ exists to facilitate the global realization of Network Centric Operations/Net Enabled Capability. We seek to enable interoperability across joint, interagency, intergovernmental, and multinational industrial and commercial operations.

- Global Organization
- Voice of industry
- Cadre of technical experts
- Dedicated to interoperability
- Advisory Council of senior advisors who help prioritize our work in a non-competitive environment

In the photo: BrigGen Dieter Dammjacob (DEU AF)-J3 NATO Supreme Headquarters, Allied Powers Europe; Lt.Col. Danut Tiganus-CIS Directorate, EU Military Staff; Dr. Tom Buckman-NC3A Chief Architect; Gen Harald Kujat,-German AF (Ret.) former Chief of Staff of German Armed Forces & head of NATO Military Committee, Marcel Staicu-European Defense Agency NEC Project Officer .

NCOIC Members

- **80+ Member Organizations** including leading IT and Aerospace & Defense companies, government organizations, non-governmental organizations and academic institutions
- **Members from 18 Countries**
- **Advisors from 26 key stakeholders** from Australia, EDA, France, Germany, Italy, NATO, The Netherlands, Sweden, UK and US

Working Group collaboration

Executive and Advisory Council joint meeting

Technical Council

Terry Morgan honors outgoing Advisory Council Chair, Keith Hall

Collaboration

- NCOIC facilitates interoperability by collaboration
  - Member organizations & Advisory Council
  - Our member's customers
  - Agencies of global governments
  - Other NCO stakeholders

- Collaboration occurs through
  - Invited Review of developing documents & architectures
  - Joint demonstrations and white papers
  - Joint and hosted forums, symposia and workshops
  - Joint technical development with stakeholders
  - LOI, LOA, MOU, CRADA and other agreements

Photo and screen captures from member lab
interoperability demonstration, Rome, May 2010

NCOIC provides guidance for network centric standards and their patterns of use.

Global Stakeholders

Members develop a SCOPE™ workshop for Australian Department of Defence with Rapid Prototyping Development & Evaluation organization

CDR Fred van Ettinger, (NLD N) C2 Centre of Excellence, signs Letter of Agreement with NCOIC

Members speak with Carlo Magrassi, European Defence Agency Deputy Chief Executive for Strategy

- **“**The Australian Department of Defence is a keen supporter of NCOIC, its principles and tools. We aim to apply NCOIC’s products to our acquisition process to better define interoperability requirements and improve through-life systems integration prospects.” **John McGarry, Australian Air Commodore.**
- "We have used NCOIC’s NCAT™ tool to assess levels of interoperability during NATO Response Force exercises. Our Centre of Excellence found the tool to be very useful in establishing the level of interoperability." **Commander Fred van Ettinger, Section Head of the Multi National Command and Control Centre of Excellence.**
- **“**NCOIC has four characteristics which make it unique. The organization is solely dedicated to network-centric operations and interoperability; its membership stimulates discussions about global interoperability; it serves as a ‘vendor neutral’ forum, and it has a cadre of industry’s top technical experts who are available to do its work.” **Jack Zavin, U.S. Office of the Assistant Secretary of Defense, Networks and Information Integration.**

Relationships

- **Government**
  - Australia Defence Organization (ADO)
  - Eurocontrol
  - European Defence Agency
  - NATO
    - ACT
    - NC3A
    - NCSA
  - Netherlands Command & Control Centre of Excellence
  - Sweden Civil Aviation Authority (LFV)
  - Sweden Defence Materiel Administration (FMV)
  - US Defense Information Systems Agency (DISA)
  - US Department of Homeland Security (DHS)
  - US Federal Aviation Administration (FAA)
  - US Joint Forces Command (JFCOM)
  - US NAVAIR
  - US SPAWAR
  - OSD(NII)
- **Organizational**
  - Australia Defence Information & Electronic Systems Association (ADIESA)
  - NATO Industry Advisory Group (NIAG)
  - OASIS
  - World Wide Consortium for the Grid (W2COG)

2008 IDGA Award:
Outstanding Contribution
to the Advancement
of Network Centric Warfare

NCOIC Key Deliverables

Addressing Inter-Agency, Cross-Industry NCO Gaps

- **Systems, Capabilities, Operations, Programs, & Enterprises (SCOPE™) Model**
  - Characterization of commercial, civil, and government requirements for interoperable systems
- **NCOIC Interoperability Framework™ (NIF) and Net Centric Patterns**
  - Recommendations for open standards and their patterns of use to obtain interoperable systems
- **Building Blocks**
  - Catalog of COTS & GOTS open standards based products compliant with NIF recommendations
- **Network Centric Analysis Tool™ (NCAT)**
  - Netcentric analysis of system architectures, including System-of-Systems and Federation of Systems architectures
- **NCOIC Lexicon**
  - A glossary of terms and definitions that lay the foundation for meaningful discussions. Provides a common language for the disparity of ideas concerning key terms, including "NCO."
- **Systems Engineering best practices and processes**
  - These best practices and processes include tools, process and maturity models, modeling techniques, and collaborative environments for NCOIC integration.

These products, combined with NCOIC member expertise in NCO/NEC, measure netcentric capabilities ,requirements, gaps and provide recommendations for interoperability

Sustained Effort to Make NCOIC Products Part of Procurement Process

<u>Overarching Goal</u>: NCOIC deliverables are adopted, utilized and required by customer agencies

Advise — Participate — Adopt — Require

2004/2005 — 2006 — 2008 — 2009 — 2010

Advise

- **All Advisory Council Members**
- **US Defense Science Board**

Participate

- **NATO**
  - C3 IPT
  - NCA FT
- **DISA (US)**
  - CRADA
  - OSWG
  - NCAT
- **OSD-NII (US)**
  - NCAT
  - OSWG
  - Cybersecurity
- **FAA/JPDO (US)**
  - Aviation IPT (NextGen/NEO)

Adopt

- **NATO C2COE NRF**
  - NCAT
- **USAF SPACECOM**
  - NCAT
- **FAA/Eurocontrol**
  - SCOPE/NCAT/Pattern s
  - FAA OTA
- **US DoD**
  - Net-Centric Attributes
- **Australian DoD**
  - SCOPE/NCAT
  - Patterns/BBs

Require

- **US DOD/DAU**
- **Aus DoD/RPDE**

NCOIC is Pursuing Plans to Further Increase Influence in Future Procurements

NCOIC Terms

- Network-Centric:
  - Related to systems and patterns of behavior that are influenced significantly or enabled by current and emergent networks and network technologies. Often these center around IP-based internetworking, but the term is sometimes used to include any type of enabling network.
- Network-Centric Operations (NCO):
  - An information superiority-enabled concept of operations that generates increased combat power by networking sensors, decision makers, and shooters to achieve shared awareness, increased speed of command, higher tempo of operations, greater lethality, increased survivability and a greater degree of self-synchronization.

Net-Centricity Requires Interoperability

Interoperability Definitions

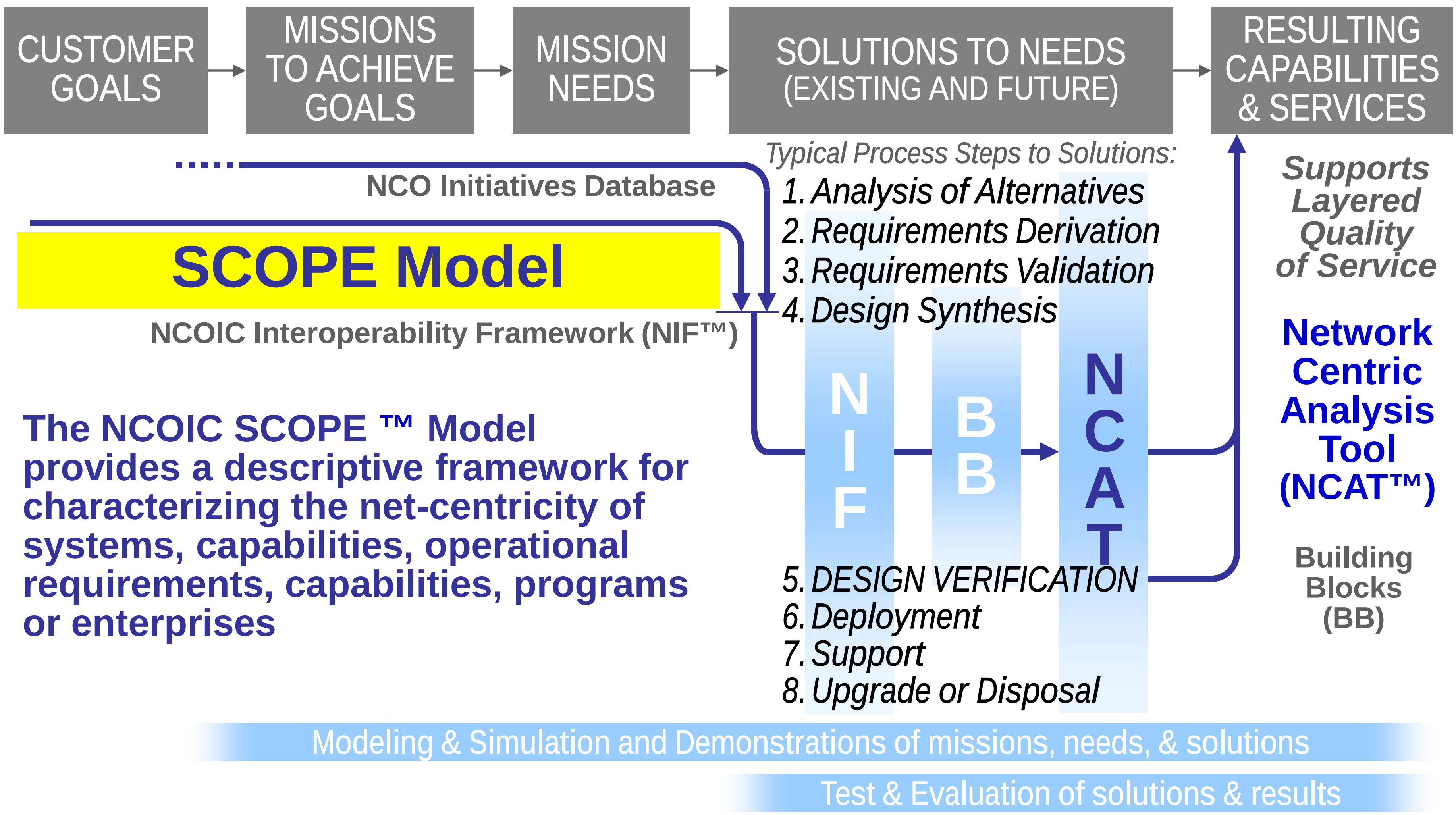
- (**DOD/NATO**) *The ability of systems, units, or forces to provide services to, and accept services from other systems, units, or forces and to use the services so exchanged to enable them to operate effectively together. (Joint Pub 1-02)*
- **(DOD only)** *The condition achieved among communications-electronics systems or items of communications-electronics equipment when information or services can be exchanged directly and satisfactorily between them and/or their users. The degree of interoperability should be defined when referring to specific cases. (Joint Pub 1-02)*
- (**NATO**) *The ability to operate in synergy in the execution of assigned tasks. (AAP-6 [2005])*
- (**IEEE**) … the ability of two or more systems or components to exchange information and to **use the information that has been exchanged**
- (**Wikipedia**) **Interoperability** is connecting people, data and diverse systems. The term can be **defined in a technical way or in a broad way, taking into account social, political and organizational factors**.

The Essence of Net Centricity

- It's the opposite of system-centricity and enterprise integration
- It's about dynamic crossing of system and organizational boundaries to achieve objectives
  - Greater operational effectiveness through better use of what already exists – not just what you "own" or control
- It's not about the network – it's about who and what you can interact with via the network for your purposes when you need to
- It challenges existing business/acquisition and doctrinal paradigms and incentive models – more revolutionary than most realize
- It challenges system-centric system engineering and architecture paradigms
  - It similar to the relationship between ecology/evolution and biology
  - How do you engineer parts that support a variety of architectures?

Net-Centricity – a full contact social sport

NCOIC Assists Customers in obtaining interoperable solutions



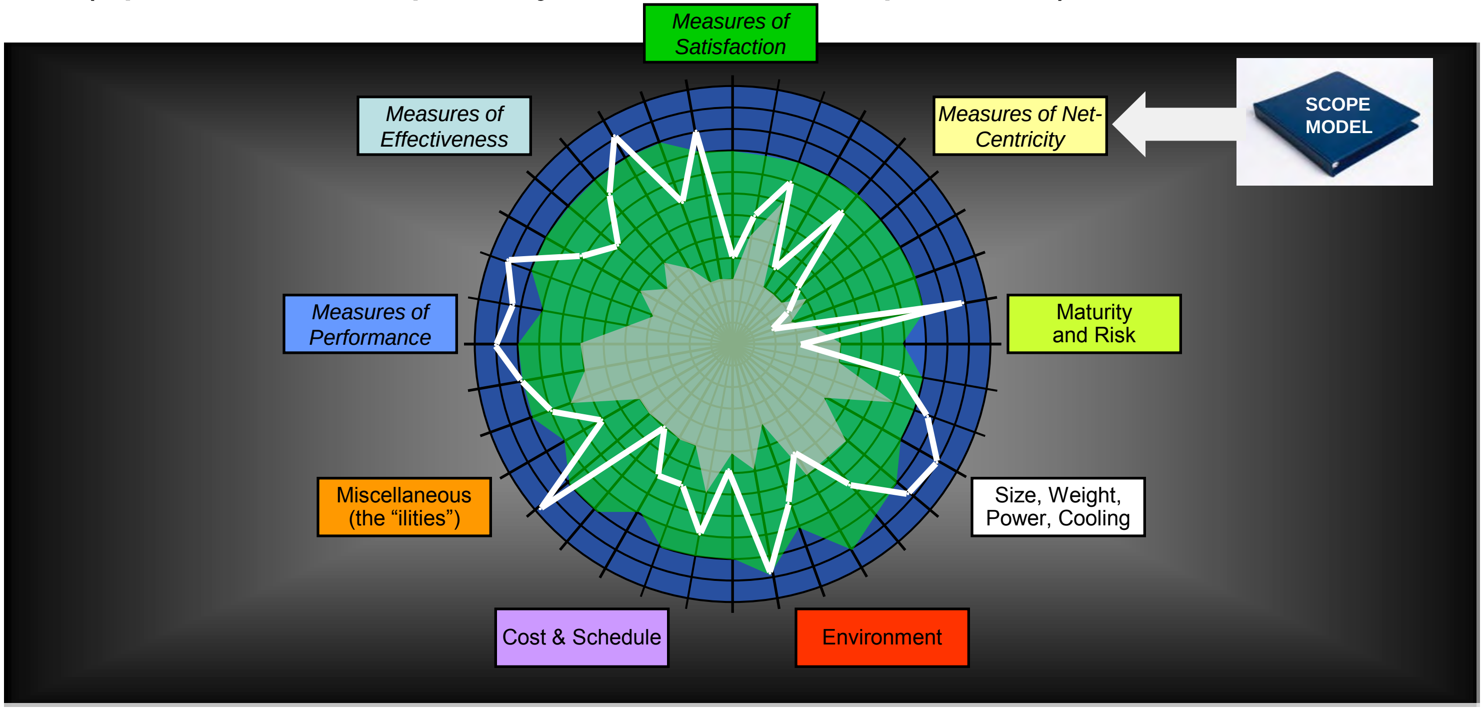
SCOPE MODEL OVERVIEW AND RATIONALE

What is the SCOPE Model?

- Systems, Capabilities, Operations, Programs, and Enterprises (SCOPE) Model
- SCOPE gives customers and companies the means to characterize <u>interoperability requirements</u> for
  network centric systems
  – How isolated or connected are the systems to each other?
  – How isolated or connected are the systems to their environment?
  – What are the intended purposes of the connection between systems?
  – What portion of operational space do the systems address?

SCOPE Working Group Charter

- Charter:
  - Develop and evolve a means to characterize requirements for network centric systems, capabilities, operations, programs and enterprises
  - Work with Functional Teams, IPTs and WGs to enable and learn from application of this characterization to actual pattern development (operational, capability, and technical patterns)



Why SCOPE?

- First need to understand Net-Centricity and what is driving it
  - A single system can't be net-centric; other systems provide context for its net-centricity
- Also need to understand what systems are and how they relate to institutions that sponsor them
  - Objectives and Contexts
  - Scope of those objectives and contexts
  - Perspectives on those contexts, including externally driven contexts
  - Frames of reference used to describe contexts and perspectives in systems that support them
- Need to understand that all systems having information service or communication capabilities are models of operational space
  - All models are wrong and incomplete (authoritative or not)
  - Some models are useful in some contexts for some objectives
  - Degree of model coupling to various contexts can vary
  - Models have institutional and operational scope and context

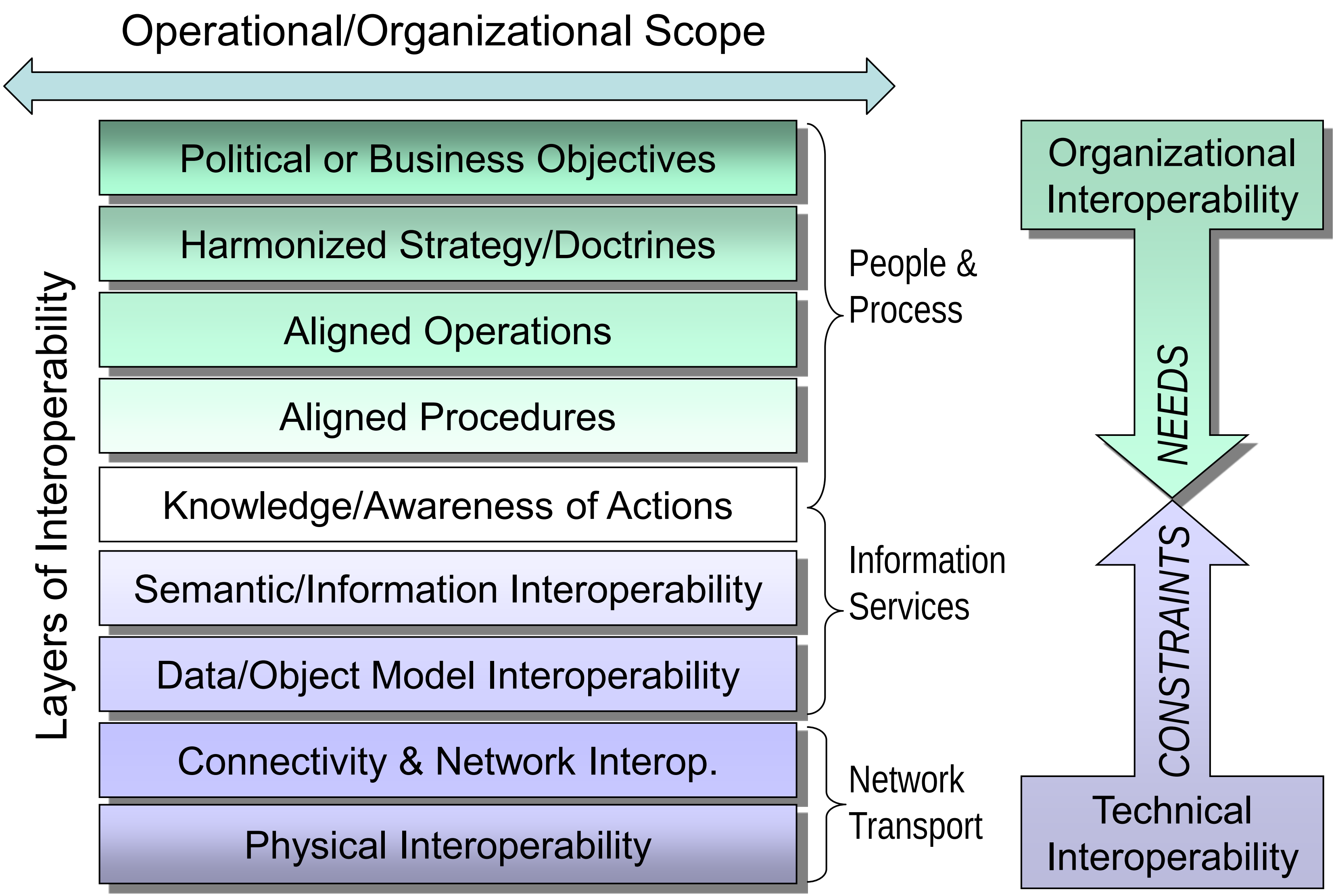
SCOPE Evaluates System/Organizational Interoperability Requirements (Not Just Technology)

How we Organize, Operate and Interact in a net-enabled environment

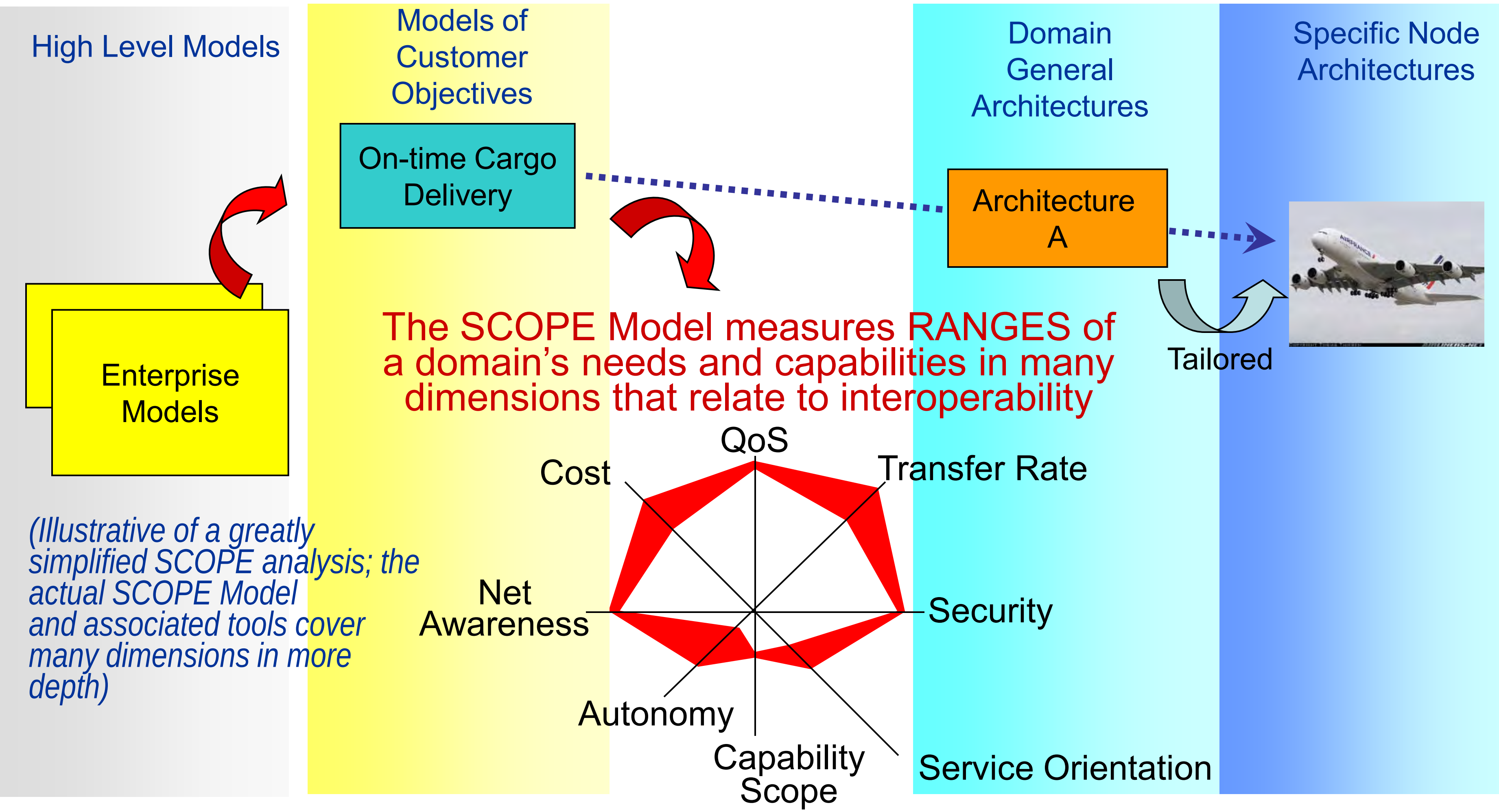
Our willingness to change, trust, delegate and enable – and why!

Technology is important, not in itself, but as an ENABLER (and a limitation) for achieving the benefits of NCO

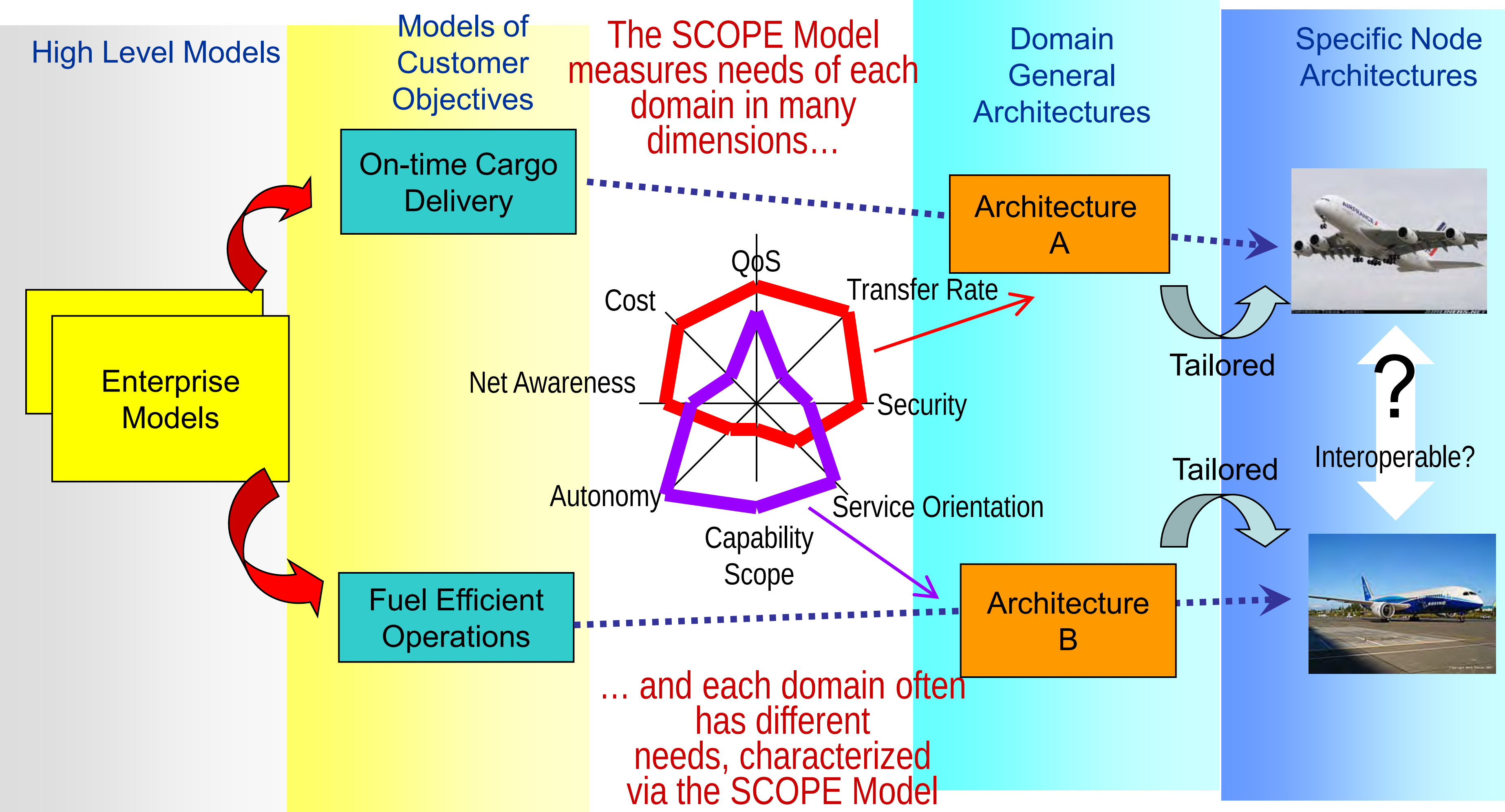
Layers of Interoperability



The Role and Value of the SCOPE Model



The Role and Value of the SCOPE Model



SCOPE Model Overview

Systems, Capabilities, Operations, Programs, Enterprises (SCOPE)

- An enterprise has scope in operational, time, resource and other domains
- So does a capability, which may involve multiple enterprises
- A capability is the potential to conduct operations of a certain type and scope
- Most enterprises have multiple capabilities and use them to varying degrees to achieve enterprise goals in conducting operations
- An operation is a kind of enterprise, usually with more limited time span and goals
  – But some operations dwarf many traditional "enterprises" – e.g., Iraqi Freedom, WW II
- A program is a mini-enterprise/operation focused on building a system that provides some capability fragment for a larger enterprise
- A program may be responsible for developing multiple systems needed for a capability (e.g., a Lead System Integrator (LSI) program)
  – More often a capability is implemented through multiple systems under heterogeneous sponsorship (Lead Capability Integrator?)

Net-Centric Architecting encompasses both single program capability engineering and multi-program/system/enterprise interoperability

SCOPE Purpose

- Provide a measurement framework for describing to what degree a set of Systems/Services supports a Capability, Operation, Program or Enterprise (SCOPE) over a network
  - Whether the set constitutes a family of systems, a system of systems, or just an ad hoc grouping is contextual and a matter of degree
  - Can involve multiple capabilities, programs, or enterprises
  - Helps define the scope and diversity of the systems in a given context
    - Highlights nature of issues affecting system interoperation
  - Helps identify how a given system could better support the larger context in a net-centric ecosystem ("scope creep")

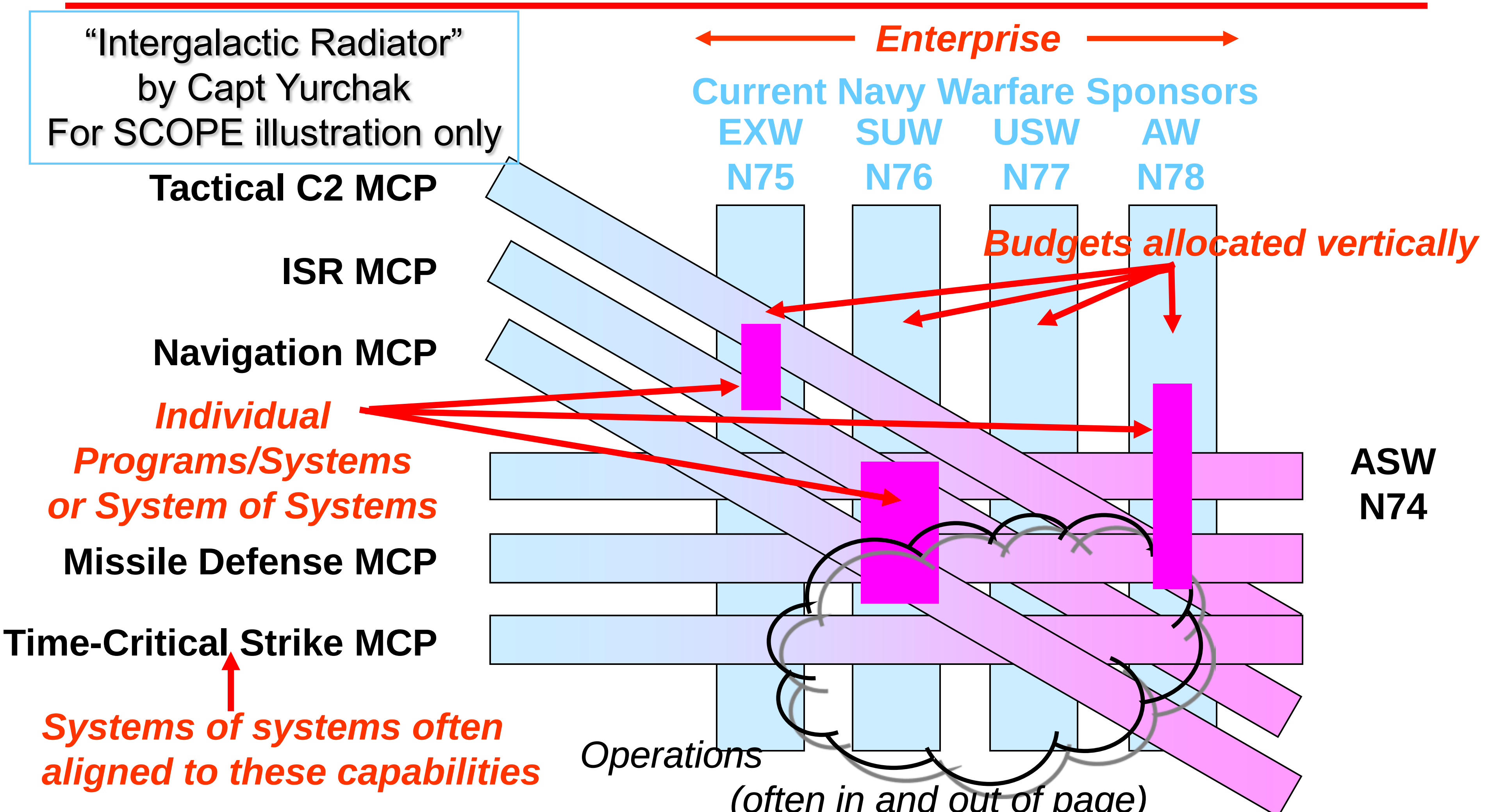
How open are the systems to each other and to their enviroment and what purposes do they support?

SCOPE Model Features

- Net Readiness Dimension set
  – Measures how open and adaptable component systems are to working with each other over the network
- Capability/Operational Scope Dimension set
  – Measures how broad, deep, and <u>diverse</u> the operational architectures are that the systems are designed to support
- Technical Feasibility Dimension set
  – Measures how feasible it is to achieve desired operational capabilities, given the systems and their information exchanges over the available network using established technical standards and infrastructure services

Net-centricity is not free, adaptability is purpose-driven, and the network is only somewhat transparent

Relating Systems of Systems, Capabilities, Operations, Programs, and Enterprises (SCOPE)



Illustrates Complex Dependencies in Capability Acquisition

Capability Scope Dimension Overview

Value / Dimension	Narrower Scope ⟵		⟶	Broader Scope
Overall Scope and Types of Enterprise	**Single Unit**	**Single Service or Agency**	**DoD-Wide**	**World-Wide**
Capability Breadth	**Single Functional Domain/Service**	**Multi-Domain, Multi-Service**	**Multi-Dept, NGO, Industry**	**Coalition, Multi-Enterprise Type**
Capability Depth	**Single Level**	**Two Levels**	**Three Echelons**	**Four or More Echelons**
Organizational Model and Culture	**Rigid Hierarchy, Vertically Integrated**	**Adaptive Hierarchy, Interact Horizontally**	**Flat, Empowered, Open to Partnering**	**Adaptive, Social, Interdependent**
Unity of Life Cycle Control/Alignment	**Single DoD Acquis. Exec**	**Multiple DoD Acquis. Exec**	**DoD & US Syst. Owners**	**Multi-National Syst. Owners**
Acquisition Congruence (SD)	**All Systems on Same Timeline**	**Timeline within 2 years**	**Timeline within 5 years**	**Timelines >5 years apart**
Semantic Interoperability	**Single Domain Vocabulary**	**Multi-Domain Vocabulary**	**Single Language**	**Multiple Languages**
Operational Context (SD)	**Single Ops Context**	**Multiple Ops Contexts**	**Future/Past Integration**	**Hypothetical Entities**

Program X Capability Scope Dimension Example

Dimension \ Value	Narrower Scope			Broader Scope
Overall Scope and Types of Enterprise	**Single Unit**	**Single Service or Agency**	**DoD-Wide**	**World-Wide**
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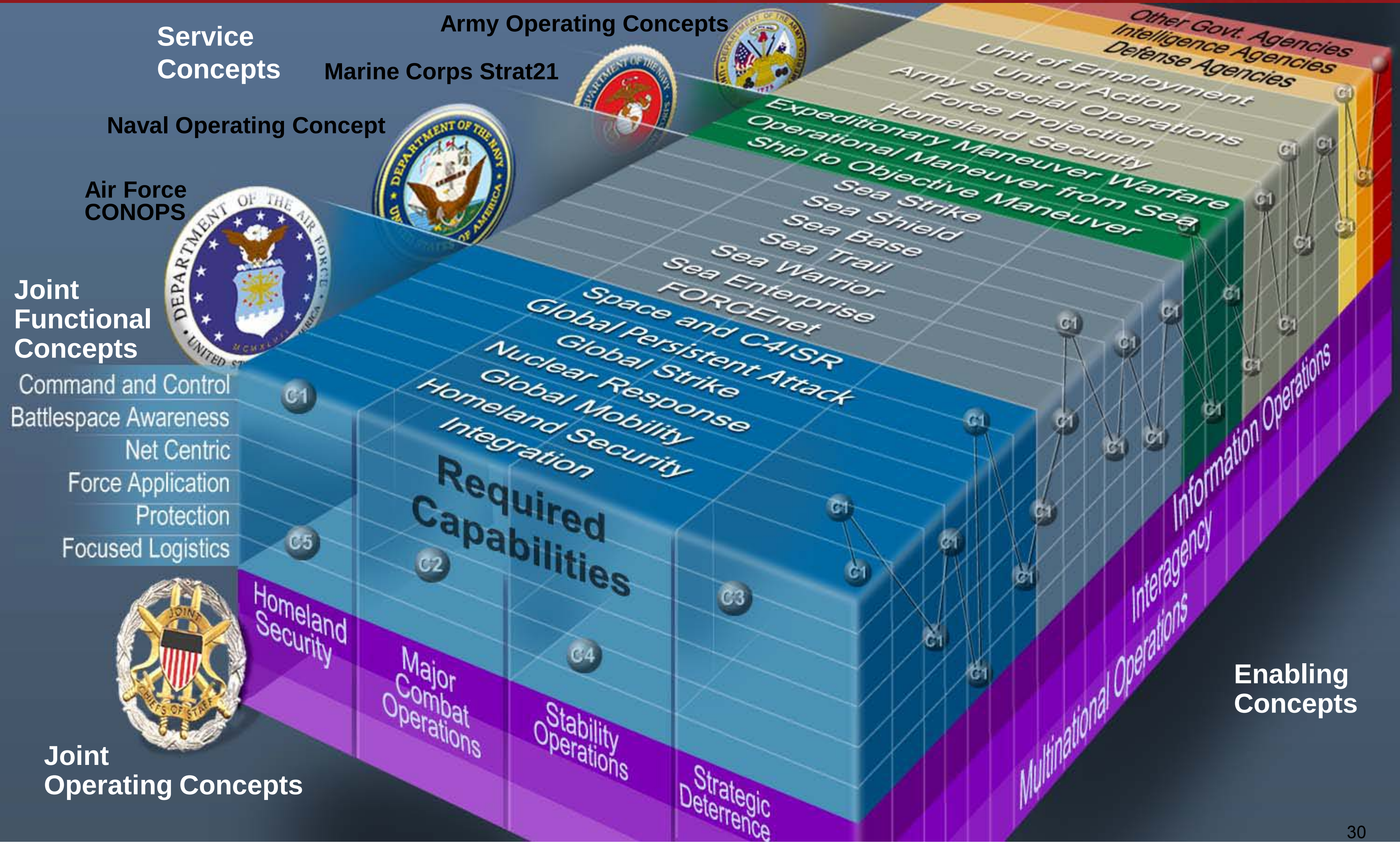
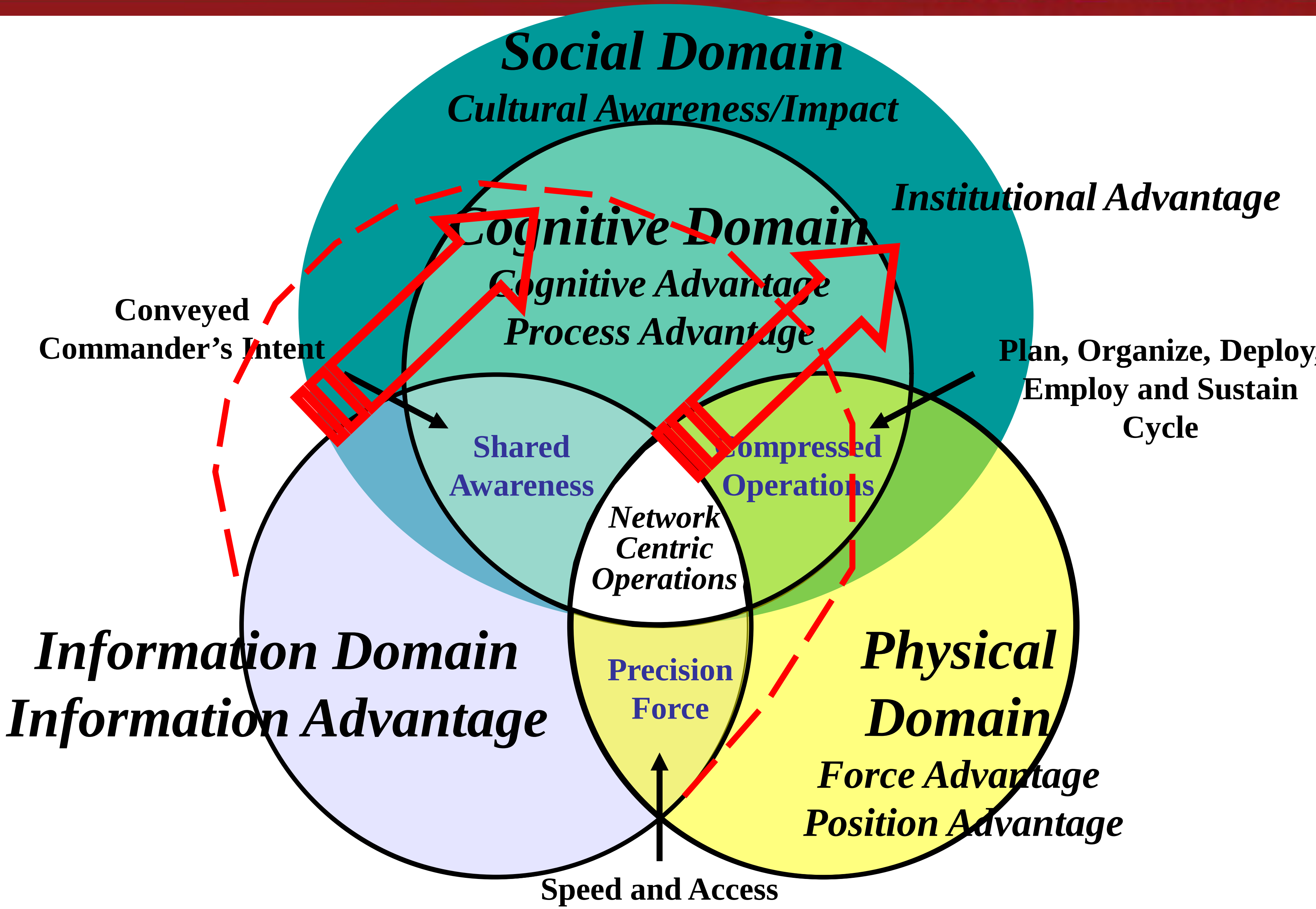
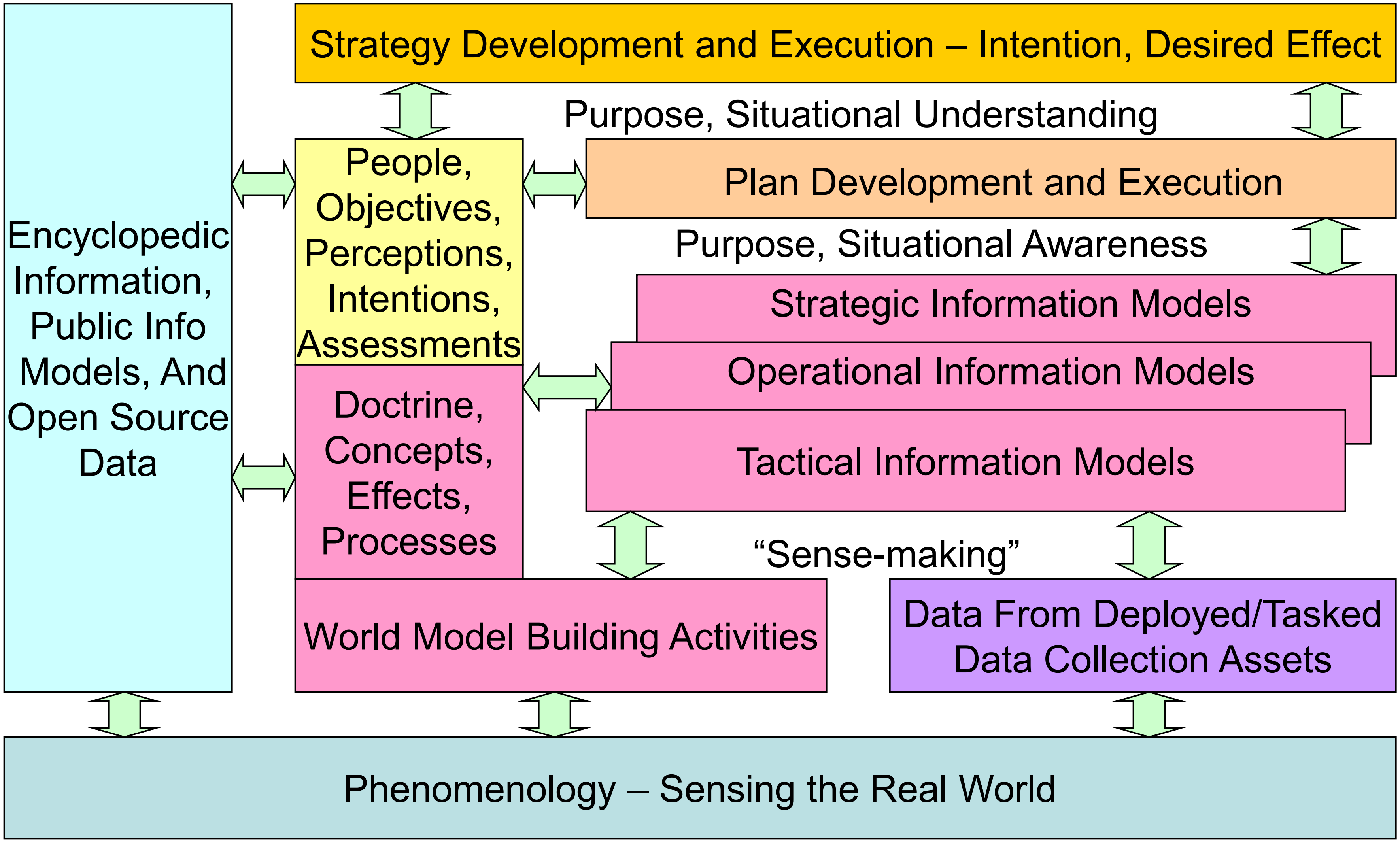
One Possible Enterprise Breadth “Hypercube”



Net Enabling the Social and Cognitive Domains Through the Information Domain



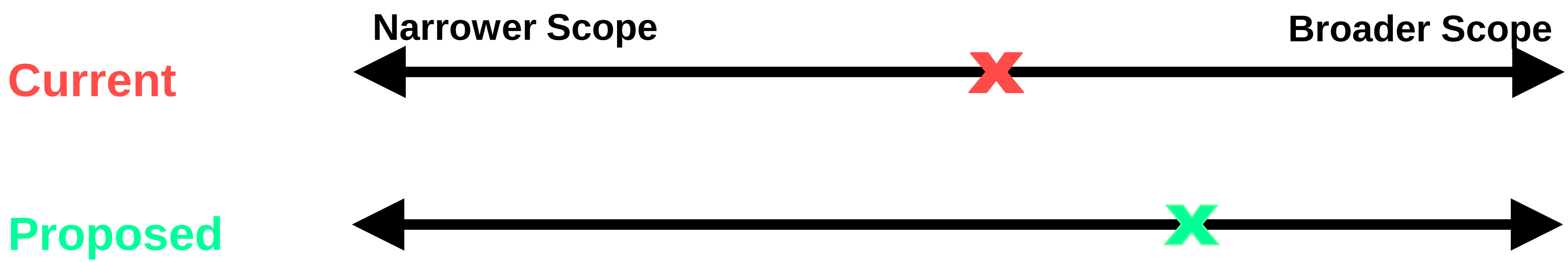
Capability Information Domains



Sample Capability-Specific Scope Dimensions

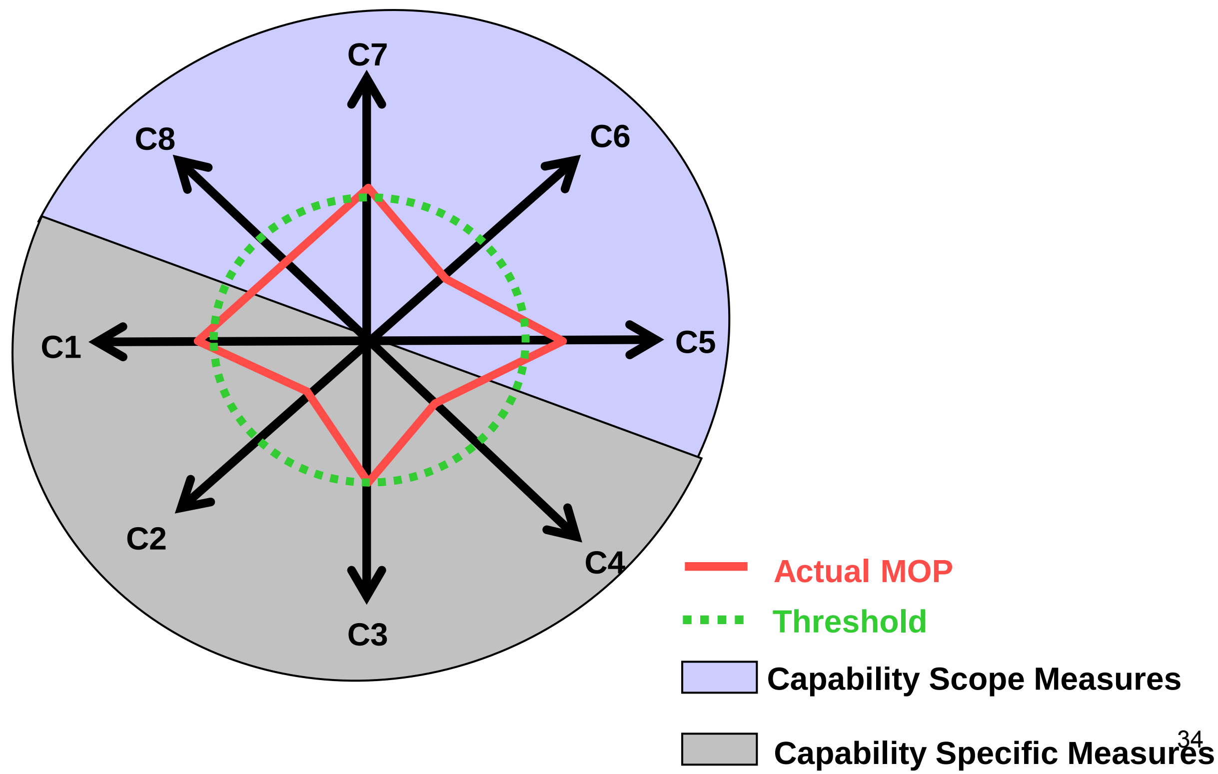
Value / Example Dimensions	Less Capability ⟵			⟶ More Capability
Time to Target Engagement	1 Hour	30 Minutes	10 Minutes	1 Minute
Stryker Bde Deploy Time	30 Days	7 Days	72 Hours	24 Hours
Total Lift Capacity	Single aircraft type	Multiple aircraft types	Multiple lift types	All lift types
Target Detection	Single sensor	Multiple sensor	Multiple sensor types	All source
ISR Management	Single Platform	Multiple Platforms	Multiple platform types	All platform types
Logistics Support	Single Weapon System Type	Fixed Wing Air Support	Multi-Class Supply	All Classes of Supply

Sample Functional Capability Profile



Key Improvement Areas

- Tactical Nets
- Local Gov Interface
- Rail modes
- Support for Cross Domain Services



Net Ready Dimensions and Levels

Value / Dimension	Tighter Coupling / Less Net-Readiness			Looser Coupling / More Net-Readiness
Service Discovery	Service specs pub at design	Service specs pub run-time	OWL spec for Services	Comparative service select
Information Discovery	Static Indexes	Metadata Navigation	Relevance Measures	Context-driven Search
Info Model Pre-Agreement	Complex data & doctrine	Standard XML Schemas	Business Object	ASCII, URLs
Information Assurance	Link encrypt - SSL	Single sign-on support	DoD-Wide PKI support	MSL, cross-domain spprt
Autonomic Networking	Design Time Configuration	Run Time Re-Configuration	Dynamic Net Management	Adaptive Net Management
Semantic Interoperability	No Explicit Semantics	Semantic Metadata for Interfaces	Ontology-based interfaces	Dynamic Ontology mapping

Technical Feasibility Dimensions

Dimension \ Value	Smaller Risk ←			→ Larger Risk
Inter-System Time Binding to Achieve Capability	Strategic	Tactical	Transactional	Real Time
Run-Time Computing Resources Needed	<1% of existing system resources	1-10%	10-50%	>50% of existing system resources
Service Mgmt. Resources Needed	Negligible	Within Current Net Service Capacity	Within Planned Net Service Capacity	Beyond Planned Net Service Capacity
Net Resources Needed (FD)	Negligible	Within Current Net Capacity	Within Planned Net Capacity	Beyond Planned Net Capacity
Interface Development Complexity	<1% of system size	1-10%	10-50%	>50% of system size
Technology Readiness Level For Net Use	TRL Levels 8-9	TRL Levels 6-7	TRL Levels 4-5	TRL Levels 1-3

SCOPE Model Summary

- SCOPE is a comprehensive, balanced approach to assessing sets of systems from a net centric operations perspective
  - Evolved through application against real programs
  - Yet has an overarching perspective on the problem space, semi-orthogonal to architecture frameworks (FEAF, DoDAF, Zachman, etc.)
- SCOPE is a “Goldilocks” model
  - No preconceived value for any given degree of net-centricity
  - Value depends on operational objectives of target system sponsors
    - Desired degree of agility
    - Desired degree of operational/resource scope
- SCOPE has potential to be a net-centric content-based complement to CMMI to characterize what is built vice how
  - But focused more on “best fit” to the problem domain rather than “maturity” or “level” based

Helps position programs/systems in the larger net ecosystem of institutional capabilities; identifies interoperability gaps among them

SCOPE Relationships

- Relationship to other NCOIC Teams/Products
- Perspective, Context, Scope, Domain, Frame of Reference, State
- Net Centric Principles and Attributes
- SCOPE & Net Centric Principles and Attributes
- SCOPE & Acquisition
- Architecture, Patterns, and SCOPE
- SCOPE & Systems Engineering
- SCOPE & Operational Effectiveness
- NIF & SCOPE
- SCOPE & Net Centric Principles and Attributes

Relationships with Other NCOIC Teams

- NCOIC Interoperability Framework FT
  - Characterize ODs in “size” and relationship space (to each other)
  - Help develop/scope Operational Description (OD) content
  - Provide way to characterize relevance of patterns to ODs
  - Owns autonomic dimensions (structure of information needed about the network and participants) jointly with SIF WG and Mobility WG
- Specialized Frameworks FT
  - SIF WG Owns Discovery and Semantic Interoperability dimensions
  - Service WG owns Service related sub-dimensions
  - IA WG Owns IA Dimensions
  - Cloud Computing WG is developing domain-dependent dimensions
  - MN WG Owns Network Utilization Dimension and supports autonomic dimensions involving network mobility (e.g., COOP, QOS)
- Network Centric Attribute FT
  - Primary internal source of criteria for analyzing degree of net-centricity in requirements contexts
  - Drives NCAT Tool features to support SCOPE workshop processes

Relationships with Other NCOIC Teams

- System Engineering & Integration FT
  - Support conceptual and process integration of SCOPE model into overall NC engineering process model (e.g. Practitioner's Guide)
  - Support development of net-centric attributes appropriate to Test and Evaluation contexts
- Modeling and Simulation FT
  - Owns dimensions/attributes related to "alternate reality" contexts
- BB FT
  - Uses selected SCOPE dimensions to characterize scope of applicability of Building Blocks to specific ODs, use cases.
- IPTs
  - Apply SCOPE analysis within each IPT to define bounds of IPT charter or OD and help decide degree of net-centricity appropriate for each use case (apply "Goldilocks" principle)
  - Determine degree of applicability of net-centric patterns developed by an IPT – e.g. Sense & Respond Logistics OD and patterns

Key Definitions

- Operational Context: The attributes which characterize an entity's purpose & state, within some scope, often shared with other entities
- Perspective: a particular system's or individual's version/view of some context/entity for its purposes
- Frame of reference: The representational convention used to describe some entity along one or more attribute dimensions, including context attributes
- Scope: the portion of possible real world and conceptual entity space a given system, context, perspective, or frame of reference includes
- State: The value of context and other variable attributes for an entity at some time or interval in some frames of reference
- Domain: A named subset of functional/operational space with specified scope and specialized perspectives and frames of reference for describing operational context and state, shared among some entities

Key Definitions
Principles and Attributes

- Principle -- A basic generalization that is accepted as true and that can be used as a basis for reasoning or conduct.
- Attribute, property, dimension -- a construct whereby objects or individuals can be distinguished from each other
  - I.E., They are observable, and, ideally, measureable
- Characteristic, feature -- A prominent aspect of something; a distinguishing quality

- Simply put, ‘principles’ allow the selection of ‘attributes’ or ‘characteristics’ that are deemed useful for certain contexts
- ‘Characteristics’ or ‘Attributes’ are used to distinguish or select systems
- Thus, in identifying the core principles of net-centricity the goal is that these ‘principles’ may be used to select essential and relevant characteristics and attributes of net-centricity.

Net Centric Principles and Attributes

- NCOIC has a multiplicity of principles, e.g.:
  - NIF Architecture Principles
  - Net-Centric Services and SOA Principles
  - Mobile Networking Principles
  - Information Assurance Principles
- All these principles assume a specific application context, namely:
  - Architecting, services/SOA, mobile networks, security architectures
- NCOIC also has a Position Paper with a definition of net-centric operations
- But all these principles and definitions still represent net-centricity from a somewhat scope constrained perspective
- Review of the DoD Net Centric Attributes drove the development of a draft set of principles that are fairly scope/context independent

Net Centric Principles

- ***Explicitness***
  - An entity should make all information about itself explicit
- ***Symmetry/Reciprocal Behaviors***
  - Relations and entities should exhibit symmetric characteristics and behaviors
- ***Dynamism***
  - Entities should support dynamic behaviors
- ***Globalism***
  - There should be no a priori bounds on the scope of applicability
- ***Omnipresent/Ubiquitous Accessibility***
  - Entities should have omnipresent or ubiquitous access to resources (i.e., each other)
- ***Entity Primacy***
  - Entities have existence distinct from the contexts in which they participate

Net Centric Principles

- ***Relationship Management***
  - **Relations among entities should be explicitly represented and provide for negotiation, creation, change, and termination**
- ***Open World***
  - **Entities should allow for open-ended representations and interactions with other entities; extensibility and scalability**
- ***Pragmatism***
  - **The ability to improve operational effectiveness is paramount**
  - ***Trumps the other principles***

Net Centric Attributes

Attribute	Description
Internet & World Wide Web Like	Adapting Internet & World Wide Web constructs & standards with enhancements for mobility, surety, and military unique features (e.g. precedence, preemption) .
Secure & available information transport	Encryption initially for core transport backbone; goal is edge to edge; hardened against denial of service.
Information/Data Protection & Surety (built-in trust)	Producer/Publisher marks the info/data for classification and handling; and provides provisions for assuring authenticity, integrity, and non-repudiation.
Post in parallel	Producer/Publisher make info/data visible and accessible without delay so that users get info/data when and how needed (e.g. raw, analyzed, archived).
Smart pull (vice smart push)	Users can find and pull directly, subscribe or use value added services (e.g. discovery). User Defined Operational Picture vice Common Operational Picture.
Information/Data centric	Information/Data separate from applications and services. Minimize need for special or proprietary software.
Shared Applications & Services	Users can pull multiple applications to access same data or choose same apps when they need to collaborate. Applications on "desktop" or as a service.
Trusted & Tailored Access	Access to the information transport, info/data, applications & services linked to user's role, identity & technical capability.
Quality of Transport service	Tailored for information form: voice, still imagery, video/moving imagery, data, and collaboration.

NCOIC Net Centric Attributes

- Based on Invited Review of the US DoD Net Centric Attributes
- To be published shortly
- Generally **less implied US DoD context**, more “generic”
- Rearranged some attributes and split them into multiple attributes
- Recommended adding some attributes for **human interoperability and more non-technical attributes related to organizational relationships**
  - No major changes from current DoD set otherwise
- Recommended developing a more comprehensive set of explicit **assessment contexts** for selecting and specializing attributes
  - Enterprise context (US DoD, NATO, NCOIC, RPDE, etc.)
  - Life Cycle Phase (of system/capability being assessed)
  - Type of System/Capability (Infrastructure, mission application, etc.)
  - Attribute Application Purpose (why are the attributes being applied)

NCOIC Recommended Attributes

Title	Description
Media Independence	Information used, produced, published, or disseminated by the services or systems is decoupled from transport mechanisms.
Open-Ended Pervasive Accessibility	Ability of system(s) or service(s) to find, use, and control information (which requires an ability to identify and distinguish entities and the publication of information with minimal a priori constraints).
Open Standards Based	To support interoperability programs/projects, systems, and services must maximize the use of openly available and unencumbered technical and process standards that support media independence, pervasive accessibility, and trustworthy control of access to information and services.
Protected and Assured Transport Services	Program/project, system, or service makes use of existing specified assurance, protected, and defended transport services where feasible/available. Infrastructure systems provide specified assurance, protected, and defended transport services that are accessible and available wherever and whenever needed
Producer/Publisher Trust Relationships [with users and services]	Program, system, and/or service(s) has mechanisms for establishing and maintaining appropriate trust relationships with users and services on the network. Measures are taken to comply with any security labeling, data protection, and access control requirements entailed by the trust relationships and monitor the environment to ensure that conditions on which the trust relationships were established have not changed

NCOIC Recommended Attributes

Title	Description
Post Data/Information for Network Access	Program/project, system, and/or service(s) has made their products discoverable and accessible on the network in a manner and timeframe appropriate to the nature of the information/data.
Adaptive Information Access	Program/project, system, and/or service(s) has provided users and services access to information and data in ways most appropriate for their context while allowing them to negotiate access arrangements and understand the associated costs.
Information and Data Independence	Program/project and/or system has separated its information and data from applications and services (dependencies) and is provided with sufficient context (i.e., metadata) to enable users to use the information/data correctly for their purposes.
Tailored Resource Access	Service levels can be modified, tailored, or negotiated to meet needs as represented by identities, roles, and/or contexts.
Social & Cognitive Integration	Programs/projects and/or systems include measures of social and cognitive integration that facilitate their effective use.

SCOPE and Net-Centric Principles and Attributes

- SCOPE provides a way to be more explicit about the scope assumptions under which a particular system/entity operates
- Also identifies hierarchical or other asymmetric relationship assumptions in capability scope and net ready dimensions
- Net ready dimensions focus on dynamism while capability scope define operational range across which one needs to be dynamic
- Capability scope dimensions encourage global thinking
- Net ready dimensions look at accessibility over the network while technical feasibility dimensions look at constraints the network imposes on ubiquitous accessibility
- Capability scope dimensions are the primary means of exploring the application of the entity primacy principle
- Both net ready and capability scope support application of the relationship management principle
  - Organizational Business Model and Culture dimension in particular

SCOPE and Net-Centric Principles and Attributes

- The technical and economic feasibility dimensions support application of the scaling principle
  - So do the net ready autonomic and semantic interoperability dimensions
- They also support the application of the pragmatism principle
  - So do the acquisition alignment capability scope, the net ready autonomic and semantic interoperability dimensions

- Similar mappings of the principles to the Net Centric Attributes are provided in the Net Centric Attributes Invited Review paper
  - Also includes assessment context model, which is basically a subset of the SCOPE capability scope dimensions
  - Mapping is not surprising since the SCOPE model was influenced by the DoD Net Centric Attributes during its development

SCOPE & Acquisition

- Most system/capability acquisitions have defined scope
  - However, not all scope dimensions are typically specified
  - Many are implicit in the acquisition source/context
  - Some are encouraged to be "flexible", "agile", or "adaptable", usually with little specificity as to type and range of flexibility desired
  - SCOPE provides a way to be more explicit about scope and about degree of flexibility/agility desired and affordable
- Some acquisitions are subject to external forces that can lead to changes in scope during or post acquisition
  - Can lead to significant ECPs and rework
  - SCOPE allows developers to consider such possible scope expansions/changes and anticipate them in the architecture/design
    - May not need to actually implement this flexibility
    - But anticipation reduces cost of implementation if the risk becomes reality

Integrated Architectures, Patterns & SCOPE

- Integrated architectures represent a tight coupling between:
  - Specifically scoped operational views,
  - Operational functionality allocated to specific systems/components
  - Constrained by technical standards and infrastructure
  - And, presumably, available budget
- How this coupling would change if any of the view content changes is typically not explicitly represented/captured
  - May be done as architecture is being developed
  - Usually driven by the scope of the operational architecture
  - Other coupling factors do have some influence (e.g., available infrastructure, budget)
- Works well if the scope of each view type is fairly static for at least the development/implementation life-cycle

The Net-Centric Challenge

- Changes in desired operational architecture functionality occur faster than the development life-cycle
- Scope of operational architecture is also dynamic
- Technology evolution and changes/variability in available infrastructure also undercuts static coupling to specific network capacity and protocols
- Coupling between scope decisions in architecture view types not explicitly represented
  - Change management becomes slow, difficult, error-prone
- Few integrated architectures survive operational deployment intact for very long
  - Requirement/Environment changes apply pressure to different parts of the integrated architecture

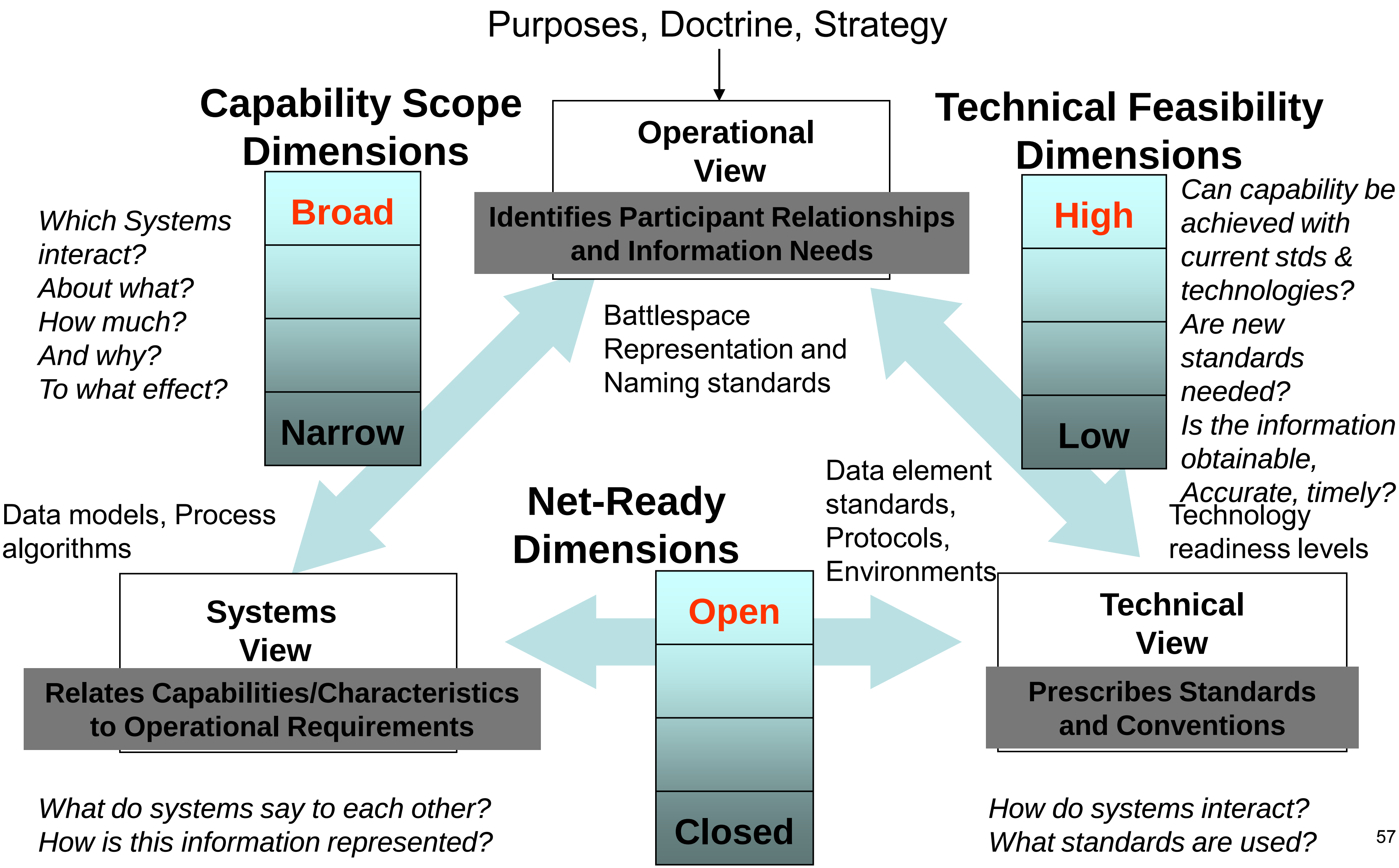
The Net-Centric Challenge (Cont.)

- One solution is to make the integrated architecture capable of dealing with dynamic scope changes
  - Complex and Expensive
  - Difficult to justify increased scope and flexibility based on “contingencies”
- Another common solution is to develop a “reference” architecture
  - Decouples and defers some operational scope decisions
    - E.g., specific country or force element types
  - May also decouple some specific system component decisions
    - E.g., specific vendor or equipment type
- But it’s relatively unusual to find a new operational problem that is a complete match for the entire reference architecture
  - Difficult to use just “fragments” of the reference architecture because of implicit coupling between elements of the architecture

Enter Patterns and SCOPE

- All too often the solution to these challenges is to develop a new integrated architecture using ad hoc architecture fragments and accumulated domain knowledge
- Patterns are essentially partially (and explicitly) dis-integrated architecture fragments
- Explicit representation of pattern scope allows semi-dynamic adaptation and composition into dynamic integrated architectures
  - Degree of design, install, or run-time composability for patterns is itself a scope decision driven by expected/desired level of agility
- Different pattern types represent different coupling decisions between architecture view types
- SCOPE is a way to represent the strength and types of coupling between architecture view types in a pattern (or architecture, etc.)

DODAF Architecture Views and SCOPE



Pattern and SCOPE Dimension Types

- Operational Patterns
  - Specify a coupling among capability scope dimensions/value ranges and at least some technical feasibility dimensions (often implicit)
  - E.g., enterprise/capability type/scale, culture/business model, context flexibility, functional concepts, etc., and, say, time-binding dimension
  - Minimal coupling to net-readiness
- Technical Patterns
  - Specify a coupling among and between net-readiness dimensions/values and technical feasibility dimensions and values
  - E.g., specific service discovery mechanisms and technical standards
- Capability Patterns
  - Specify a coupling between all three SCOPE dimension types
  - E.g., specific functional services, naming standards, technical standards and infrastructure capacities required for a capability

Key Points

- Patterns are architecture fragments with explicit scope representation of their (limited) coupling between architecture view types and ranges
- Finer-grained than complete reference architectures
- Coarser-grained than individual components and services
- Net-Centric Patterns are those that rely on network connections and protocols, as well as net-centric principles, to connect components, services, people, and institutions to each other for some purpose(s) of defined scope
- Integrated architectures can be built/composed from patterns in less time and effort than from components alone
  - Patterns contain more domain knowledge than atomic components
- Such integrated architectures are less fragile and more interoperable than those built for a single defined set of scope values

SCOPE & System Engineering

- SCOPE is a system requirements elicitation tool with a pre-defined but extensible operational attribute model
- SCOPE provides a framework for defining the scope of one system in a way that allows comparison with the scope of another system
  - Provides a descriptive framework for augmenting system context diagrams with explicit scope
  - Also useful in being explicit about scope of system use cases
- SCOPE also provides a way to describe systems along a continuum from individual component to an enterprise of enterprises.
  - No hard definition of “System of Systems”, “Family of Systems”, or “Enterprise” needed
- SCOPE has limited SCOPE
  - It only applies to those aspects of systems that are manifested in information/service request exchanges over a network

SCOPE & Operational Effectiveness

- Operational Effectiveness is often an elusive, subjective quality
- Fundamentally, net-centricity is about increasing operational effectiveness by working with other systems/entities over a network
  - SCOPE does not measure operational effectiveness itself
    - That's best left to specific system/capability/process proponents
  - SCOPE does enumerate attributes that could be enablers or barriers to operational effectiveness in a given operational context and for specific purposes
  - Examining SCOPE dimensions of a particular set of systems/capabilities can help identify unforeseen barriers to, and enablers of, operational effectiveness
  - Adjacent domain analysis portion of SCOPE Workshops helps do this
- NIAG SG-76 includes a report that describes a way to use operational effectiveness measures to identify important SCOPE dimensions for a given operational scenario

NIF & SCOPE

- The NCOIC Interoperability Framework (NIF) recommends using SCOPE to develop and specify the context and scope of Operational Descriptions (ODs)
  - ODs are high level descriptions of an operational domain
  - OD template is defined by the NIF
  - Contain:
    - Capabilities important to the domain
    - Purposes for the capabilities
    - Significant adjacent domains and domain interaction issues
    - Operational patterns and capability patterns
- SCOPE Workshops are used to help develop ODs and the adjacent domain analyses
- The NIF also points out that when there are multiple architectures interacting over the network, it's important for them to explicitly represent their respective scopes to each other

SCOPE MODEL APPLICATION METHODS AND CONTEXTS

Methods

- Workshops
  - Facilitated workshops using dimensions as structured interviewing and discussion capture tool
  - Practitioner’s guide for prepping and conducting workshops
  - Leverages facilitator expertise and broader perspective to help target understand net-centricity in target context
- Self-Assessments via questionnaire tool (NCAT, Spreadsheet)
  - May be helpful for targets already familiar with net-centric thinking
  - Generally not recommended for targets new to net-centricity
- Informal application of dimensions in other review contexts
  - SCOPE dimensions used as completeness check by reviewers
  - May also generate suggestions/recommendations

SCOPE Application Contexts

- Enterprise Integration, Strategic Planning, Re-engineering
- Program/System/Capability/Domain Requirements Elicitation
  - Operational Description Development
  - Pattern Development
- Inter-system/capability interface definition
  - Adjacent Domain Analysis
- Product Line Strategy/Design/Architecture development
- Characterizing scope of applicability of services and patterns
- Existing system/service re-engineering or evolution planning
- Standards development and characterization

NCOIC Resources for SCOPE Workshops

- Practitioner's Guide and training material for SCOPE Workshops
- SCOPE Excel Spreadsheet with SCOPE dimensions in the form of questions and potential answer values
- Sets of domain-dependent scope dimensions developed for specific operational and technical domains
- NCAT Tool capable of using SCOPE questions/answer content in a workshop format
  - SCOPE questions don't use NCAT scoring features
  - NCAT tool capable of importing Excel SCOPE questions/answers
  - Including new domain-dependent questions
- SCOPE training workshops
  - For NCOIC teams developing operational descriptions and net centric patterns
- SCOPE training material such as this tutorial

QUESTIONS? DISCUSSION?

Contact Information

- NCOIC Web Site: www.ncoic.org
- SCOPE Model document available for down load from NCOIC public site.
- Net Centric Attributes Functional Team email address:
  - net_centric_ft@lists.ncoic.org
  - Chair: Hans Polzer, hans.w.polzer@lmco.com
  - Telephone 703 416-2308
  - Vice Chair: Jack Zavin, jack.zavin@osd.mil
  - Content WG Chair: Todd Schneider, todd.schneider@raytheon.com
  - Engine WG Chair: Leslie Anderson, Leslie_Anderson@raytheon.com

Backup Slides

SCOPE Planning Workshop Overview – FFT Example

- SCOPE Model Process and Overview presentation – 30 min
- Friendly Force Tracking Overview presentation and initial context/scope setting – 30 min
- Capability-specific SCOPE dimension development and selection of additional SCOPE dimension – 60 min
  - What are the aspects of FFT by which its depth and breath can be characterized in terms specific to FFT/defense capabilities
  - What are the important adjacent domains with which FFT needs to interact?

Identifying Initial Capability to be Profiled with SCOPE

- Overall FFT Capability Domain is very broad
- NCOIC focus on security operations still leaves this as a very broad domain
- Working with selected stakeholders, NCOIC C3 IPT will need to reach out to adjacent domains
- It's important when applying SCOPE to consider the larger environment in which a capability operates
  – Consider selective scope expansion to address interactions with adjacent and supported larger capabilities
  – End-to End Force Visibility, support from and to adjacent security operations, business and social incentive models for participating in a capability
  – Coalition versus Joint vs stability ops vs commercial/NGO

Applying SCOPE to FFT

- Identify stakeholders and domain experts for FFT
  - Focus on Operational Domain users and information architects more than system architects/developers/owners
- Use overview/reference material to identify relevant SCOPE dimensions
- Tailor SCOPE questionnaire/NCAT to focus on relevant dimensions – this is a judgment call!
  - Identify potential capability-specific SCOPE dimensions
  - Add questions that probe these dimensions to the questionnaire
- Schedule and conduct structured interviews using SCOPE questionnaire with identified stakeholders and domain experts
  - Capture specific answers as well as comments for “as is” operations
  - Probe for potential “to be” desires/possibilities in each question
- Conduct initial outbrief with FFT Initiative team

Applying SCOPE to FFTI

- Conduct post-interview analysis to develop both as-is and candidate to-be SCOPE analysis for FFT Operational Description
- Conduct follow-up validation/discussion session with FFT Initiative team on results of SCOPE analyis
  - Focus on larger context issues, identify any changes
- Use resulting to-be profile to characterize attributes, information models, service interfaces, and instance naming approaches, conventions, and authorities for FFT
  - Identify those that are driven externally to the FFT capability domain
  - Identify those that FFT Capability domain needs to establish as common to FFT systems over the network
- Sample Capability-Specific SCOPE dimensions to be considered:
  - Force Tracking granularity in entity and time dimensions
  - Types of forces to be tracked

Sample Capability-Specific Dimensions generated by FFT SCOPE Planning Workshop

Sample Capability-Specific Dimensions

- Generated in FFT SCOPE Planning Workshop, May 08 with input from domain experts and applying SCOPE concepts
  - Force granularity
  - Force element and track types
  - Reporting frequency and latency
  - Track location sensitivity
  - Location precision, accuracy
  - Degree of friendliness and force element affiliation
  - Reporting push/pull
  - Information types reported
  - Tracking purposes
  - Reporting architecture and business model
  - Identity and location assurance
  - Other ways that FFT can vary in depth/breadth?

Use of Capability-Specific Dimensions

- Demonstrate relevance to target SMEs
  - Don’t claim expertise
  - NATO ACT SME’s resonated with strawman set of FFT dimensions
- Stimulate target SMEs to think multi-dimensionally in scope space
  - ACT SME’s identified 2 additional dimensions in subsequent SCOPE Workshop with them
  - Degree of penetration of force structure tracked via FFT
  - Degree of security accreditation required by FFT systems and services/features
- Drive net-centric interfaces/services specification/standards
  - NATO/ACT currently focused only on ground force FFT
  - Acknowledged need for tracking helicopters and potentially CAS force element types and vice versa
  - Averse to force element status data exchange as FFT capability due to bandwidth concerns

Adjacent Domain Exercise for FFTI

Candidate Adjacent Domains for FFT

- Command and Control (C2), RoE, Planning, Exercises, Execution
- Situational Awareness (often characterized as a sub-domain of C2, but also of Intelligence) – includes MDA as a subset
- Intelligence
- Targeting, Weapon/Target Pairing and Release Authority
- Logistics
- Transportation, especially in-transit visibility
- Asset Tracking/Inventory Management
- Force Structure, Readiness and Preparedness
- Force Deployment, “deploy to contact?”
- Civil, Emergency Response, Stability Operations
- Personnel Management
- Business Operations
- JAG, Host Nation Support, and International Legal
- Doctrinal Analysis and Development

Considerations For Adjacent Domains

- What information/services from adjacent domains could the focus domain use to help achieve its objectives?
- What are the scope and frame of reference issues with the information from the adjacent domain from the focus domain perspective?
- What information/services produced by the focus domain (FFT) could be used by the adjacent domain to help achieve it’s objectives?
- What scope and frame of reference issues exist for this information from the perspective of the adjacent domain?
- Are there incentive or business model/policy issues associated with interacting across the domain?
- Are there other modality/context issues?

Maritime Domain Awareness

- Key Information/Service exchanges with FFT?
  - AIS on helicopters
  - Ground force location information to Naval forces in amphibious or other naval fire support contexts
  - Naval platform location info to ground/air forces
- Key data elements and frames of reference shared or mapped with FFT?
- Domain scope challenges?
  - Selective activation/availability of AIS info depending on operational context
  - Data aggregation of AIS system broadcasts?
  - Long Range Identification &Tracking System? (not yet obligatory)
  - Some FFT stakeholders don’t view maritime forces as part of FFT

Maritime Domain Awareness

- Key Information/Service exchanges with FFT?
  - Provide ship tracking data to FFT
  - Validate ship tracking data by independent means (ships often mis-report their track data or actual contents)
  - Help identify who is behaving abnormally
  - Identify nationalities of ship/crew/flagging, ship contents
  - Ships are not under central control
  - Avoid ship collisions
  - Intended destinations, routes, and estimated arrival times
  - Would like to be able to track smaller ships as well as over 300 tons (AIS limit), and ships that meet certain profiles.
  - Ships acting as network relays for position/state information
  - Ships become network providers and have to handle security concerns that this role creates.
- Key data elements and frames of reference shared or mapped with FFT?
- Domain scope challenges?

S&R Logistics

- Key Information/Service exchanges with FFT?
  – Location info regarding Logistics force elements/assets (trucks, etc.
  – Logistics needs to know where consumers are
  – Logistics needs to know what consumers need (or inferred from their state info). May also need to get some of this from C2/Planning
  – Time of arrival estimates/projections; degree of commitment
  – Logistics might want to know the contents of a friendly force element such as a truck or other vehicle
  – FFT may want to know if a force element is “in/out of Supply” – could also be a C2/Situational awareness issue.
- Key data elements and frames of reference shared or mapped with FFT?
  – Location date/time, GPS/WGS-84 for location data but may use UTM grid as well.
  – Mode of transportation for tracked element (ground, sea, underwater, air, etc.)
- Domain scope challenges?

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S&R Logistics

- Key data elements and frames of reference shared or mapped with FFT?
  - Location date/time, GPS/WGS-84 for location data but may use UTM grid as well.
  - Mode of transportation for tracked element (ground, sea, underwater, air, etc.)
  - Size/mass of tracked entity, containerization
  - Affiliations and priority of support for entity being tracked
  - Billing of tracked element owner for logistics support provided
  - Specification/direction from logistics or C2 regarding which FFT elements are to be tracked in some area or time period
- Domain scope challenges?
  - Tracking aggregation services may support multiple organizations
  - Creates privacy/restricted access considerations

Possible Cloud Computing SCOPE Dimensions

- Degree of coupling between operational responsibility and execution resource ownership for
  - Network resources
  - Computing platform resources (incl plant, power, etc.)
  - Data resources – including controlled/licensed data
  - Service resources – for proprietary IP or bundled platform/data
- Business model types connecting consumer with cloud provider
  - Relationship management, consequence management
- Dynamic range of cloud services (mainly scalability)
- Network infrastructure capacity between cloud provider and consumer
- Execution platform types provided by the cloud
- Degree of domain-specificity of cloud-based services offered
- Others?

Operational to Resource Coupling Types and Measures

- Resource Types: Network capacity, nodal capacities, data ownership; service IP, others? SLA management and QOS resource management resources
- Coupling types? Common organizational policy, two party business models, national affiliation, third party payer models, others? Degree of visibility into resources available and degree of control of allocating those resources. Different cloud models have different approaches to this dimension. For example, different cloud providers have different ways to manage resources at different levels of granularity and resource type decompositions for consumption models exposed to the consumer.
- Should we take the relationship piece of this and include it with the top level Business model dimension? A better nomenclature might be “Operational Model.” Agreed to keep this as part of the top level Relationship Management dimension. What are the motivators for the coupling?

Degree of Coupling Measures

- Degree of Coupling measures? For example, Public vs Private clouds is one degree of coupling measure, but is silent on the coupling type subdimension. It's also not a very fine-grained measure, in part because there is a presumption that a private cloud is enterprise-wide inside (i.e. private) the enterprise firewall. But that's not necessarily so, depending on the enterprise in question.
  - Responsiveness of coupling? (in time units from demand signal to satisfaction?)
  - Motivation for coupling? – e.g. money, operational need, shared ideology, dictatorship, others
  - Enterprise Scope dimensions?
  - Net Ready Dimensions for services?
  - Geographical coupling? Particular related to the aggregation of resources.
  - Degree of specificity of coupling to service consumers

Business Models connecting consumer with provider

- Fee for service model
  - Commercial Service Model - fee for service models
  - Public Service Model - free or fee for service (but fee need not fully support service – subsidized by a separate body)
    - Private Service Model – Enterprise/group membership constrained to something less than general public
- Required Service Model – consumer must use provider service (e.g. vehicle registration, tax filing) by force of law/jurisdiction
- Third Party payer service model – e.g., Google search
- Community Contributor model – e.g., SETI model, botnets?
- Other business models?
  - Legacy consolidation, infrastructure consolidation
  - Insurance model (for unplanned events)
  - Charity for goodwill

Dynamic Range of Cloud Services

- Platform scalability (number of platforms available)
- Storage scalability – how much can be made available and how quickly
- Network access capacity scalability – consider Network Entity Reach (who can I reach?)
- Types of applications supported by the cloud services
  – Storage services, persistence/access speed tiering
  – Computing platform services (generic platforms)
  – Domain-specific services (e.g, image processing, search services)
- Types of coupling to the physical environment (not common, but possible in, say, sensor networks or process control services.)
- Types of coupling to the political/social environment, e.g., state, international; different currencies, languages, legal constraints
  – Coupling to social/entertainment networks, You Tube, Facebook, etc.
  – See also Enterprise Breadth SCOPE dimensions

Network Infrastructure/type capacity between consumer and provider

- LAN Bandwidths (100Mbit to 10 Gbit)
- WAN Bandwidths and latencies
- Mobile network Bandwidths and latencies
- Dedicated communication links (point to point)
- Low bandwidth and intermittent links
- Asymmetric network links (e.g. satellite with high downlink speed and limited or no uplink capability)

- Others? E.g. Cost of network usage to consumer? To Provider? Dynamic (on demand) not to exceed some level?
- SCOPE Tech Feasibility dimensions capture this as a fraction of available bandwidth. Is absolute bandwidth more relevant? How about latency or even availability of the network?

Platform types supported

- Intel Instruction set
- Other PC instructions set (e.g, Power PC)
- Small platform set (smart phone, PDA)
- High Performance platforms such as massively parallel processors, very large word size instruction set processors
- User delivery platform specificity
- OS Types supported
- Application types coupled to platform types (portability)
- Fault tolerant

- Have someone brief the CC WG on different approaches to virtualization and how those might need to be represented in cloud services to support interoperability among different cloud providers – Kayvium KVM in Toronto Ca?

Degree of Domain-specificity

- General platform services
- General purpose services, e.g.
  - Search services
  - Semantic interoperability services
- Functional domain-specific services. e.g.
  - Retail storefront services (Amazon, Yahoo, E-Bay)
  - Business function services (Salesforce.com)
  - Records management service
  - Tactical vs. Enterprise
- Single-purpose services (e.g., SETI, Human Genome analysis)
- Other gradations or sub-dimensions

Other measures of Cloud variability

- QOS measures specific to Cloud Computing?
  - Levels of privacy/security/anonymity
  - Levels of redundancy and/or physical dispersion
  - Speed of allocation of resources
  - Level of management visibility/control
- Grid Computing and High Performance Computing?
- Cloud “outsourcing” services - “private label” cloud instantiation and operation? e.g., RACE – business model type?
- Dynamic formation of clouds? Possibly from other clouds? Virtual clouds? SETI, Human Genome analysis
- Data portability and service level interoperability (beyond net-ready dimensions?)

Adjacent Domain Analysis

- What adjacent domains have information/services that cloud computing may need to interact with?
  - E.g.: platform virtualization, business relationship management (e.g., IRM/ERP, CRM, billing, demand forcasting, network management, application management, DRM, regulatory compliance management (e.g., SOX), cyber security, etc.
- What information does cloud computing have/generate that other domains may be able to use?
  - E.g: volume of data access requests, data volume stored, number of service requests by service consumers, resource units in use, etc.
- Others?
  - Application development